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Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT and the UNITED STATES NAVAL MEDICAL BULLETIN. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

The Chairman of the Armed Forces Medical Policy Council and the Surgeons General of the several services invite all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, and officers of the Veterinary Corps of the Armed Forces, and the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

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OFFICE OF THE SECRETARY OF DEFENSE
ARMED FORCES MEDICAL POLICY COUNCIL
WASHINGTON 25, D.C.

MEMORANDUM FOR: Personnel of the Medical Services of the United States Armed Forces

The Armed Forces Medical Policy Council, which was established on 2 January 1951, held its twenty-second and last meeting of the year on 17 December. It has been my pleasure to serve first as a member of the Council under the chairmanship of Dr. Richard L. Meiling, and second, as Chairman of the Council since 1 July.

In reporting some of the accomplishments of the Council during the past year, there are the standardization of medical recording and reporting procedures, the establishment of the Armed Forces Hospital Expansion Planning Program, the approval of preliminary drawings of standard plans for permanent and nonpermanent Armed Forces hospitals, the adoption of the principle of built-in clinics rather than the conventional outpatient department, the adoption of the back pressure arm-lift (Holger Nielsen) method of artificial respiration, coordination of research in the medical and health fields with the Research and Development Board, the Armed Forces Blood Donor Program, point credits for reserve officers attending the section on Military Medicine of the American Medical Association, and many others. None of these accomplishments could have been achieved without complete cooperation of the military medical services, the three military departments, and of the Office of the Secretary of Defense.

Many of the suggestions sent in to the Council from members of the military services overseas and in the Zone of Interior have been most helpful.

It is my sincere desire and belief that during this year the Council will develop programs and policies which will further assist the medical services of the three military departments in the accomplishment of their mission.

W. Randolph Lovelace, II

W. Randolph Lovelace, II, M. D.
Chairman
Armed Forces Medical Policy Council

Armed Forces Medical Policy Council (Left to Right): Maj. General Harry G. Armstrong, U. S. A. F. (MC), The Surgeon General, U. S. Air Force; Dr. Isidor S. Ravdin; Maj. General George E. Armstrong, The Surgeon General, U. S. Army; Dr. W. Randolph Lovelace, II, Chairman; Dr. Alfred S. Shands, Jr.; Dr. James P. Hollers; and Rear Admiral Herbert L. Pugh, MC, U. S. N., The Surgeon General, U. S. Navy.

Neurosurgery in World War II

Winchell M. Craig, *Rear Admiral, MC, U. S. N. R. (1)*

THE specialty of neurosurgery in the Medical Corps of the United States Navy was recognized before the beginning of World War II by the Bureau of Medicine and Surgery. The medical specialist units, of which there were 110, were made up of reserve officers who were medical and surgical specialists. On 7 December 1941, the first medical specialist unit, designated as Neurosurgical Unit Number 54, was activated, and when war was declared it was sent to the U. S. Naval Hospital, Corona, Calif. This unit included 3 neurosurgeons in addition to the other members. From that time, neurosurgery in the Medical Corps of the Navy was established, and accredited neurosurgeons were assigned to definite hospitals to follow their specialty.

Realizing that certain hospitals were better equipped to cope with neurosurgical problems than others, the Bureau of Medicine and Surgery designated certain medical centers as neurosurgical centers. At these centers, consultants in the allied fields of orthopedic surgery, plastic surgery, maxillofacial surgery, orthodontia, and other specialties were available. In the United States neurosurgical centers to which patients needing combined specialized treatment could be sent for disposition were set up at Chelsea, Mass., St. Albans, N. Y., San Diego, Calif., Philadelphia, Pa., the National Naval Medical Center, Bethesda, Md., and Oakland, Calif.

CRANIOCEREBRAL INJURIES

Infection. Although it was recognized in the years between World War I and World War II that the brain and meninges were able to resist infection to a remarkable degree, Harvey Cushing, pioneer neurosurgeon, in World War I was aware that it was usually infection which caused such complications as meningitis, abscess, and encephalitis in patients with wounds of the head. He reported that the mortality rate was 36.6 percent in patients with deep wounds of the head, whereas Geoffrey Jefferson, neurosurgical consultant in the British Emergency Medical

(1) Section on Neurologic Surgery, Mayo Clinic, Rochester, Minn.

Service, estimated that it was 20 percent. In World War I, anaerobic infections, particularly gas gangrene and tetanus, complicated wounds of the central nervous system. The development of the sulfonamides and penicillin changed the prognosis for all types of wound in World War II. Much of the information concerning the treatment of wounds of the central nervous system stemmed from the early experiences of the British. Brigadier Sir Hugh Cairns, R. A. M. C., and his colleagues advocated the use of 18 gm. of sulfadiazine on the first day in the treatment of craniocerebral injuries and 12 gm. daily thereafter in the treatment of meningitis and as a prophylactic measure. The British also initiated the use of penicillin intrathecally in the treatment of meningitis caused by micro-organisms susceptible to penicillin and showed that in cellulitis of the scalp, osteomyelitis of the skull, and fungus infections of the brain the systemic administration of penicillin was of great value.

Although there were craniocerebral wounds in which pathogenic organisms gained access to the subarachnoid spaces or ventricular system regardless of the care used in operating, it was found that, by the use of chemotherapy, complete débridement could be performed and the craniocerebral wounds could be closed without drainage, and with the use of the sulfonamides and penicillin most of them showed no evidence of infection.

Penetrating wounds of the head and retained missiles received a good deal of thought and were the cause of experimental work by the National Research Council, the Army, and the Navy. It was found that removal of a foreign body from the brain within 12 hours reduced the incidence of fatal infection. Failure of the foreign body to reach the ventricle greatly reduced the likelihood of death from a fulminating infection. At first, it was thought that an unsterile foreign body, deeply imbedded but not communicating with either the skin or ventricle, would not cause a fatal infection unless the ventricle at some time was penetrated. Early in the war, retained bone chips, rather than retained missiles, were thought to be the cause of abscess of the brain. Later, the occurrence of an abscess of the brain about a missile, although the bone chips had been completely removed, was frequent enough to direct closer attention to removal of the missile. Electromagnets used to remove bullets and steel fragments were replaced, for the most part, by the simple procedure of using a piece of magnetized steel held in a pituitary rongeur. Intracranial hematoma was uncommon in missile wounds of the brain.

It was found by the use of antibiotics that extensive reparative operations on the head for craniocerebral wounds could be delayed until the patient was transported from the front, or scene of action, to the better established hospitals where greater facilities could be maintained for the treatment of craniocerebral injuries.

Repair of cranial defects. Early in the war, the use of tantalum, a new inactive metal, and acrylic resin were recommended for repairing skull defects. Previous to the war, cranial defects had been repaired by sheets of celloidin and by flaps of the outer table of the skull and various metallic substances, including silver. The lack of reaction to the tissues made tantalum a safe metal to use in the repair of cranial defects. In naval hospitals equipped for the insertion of tantalum plates, the patient was carefully studied from the standpoint of repairing the defect as well as assisting in the relief of symptoms. It was early recognized that the insertion of a tantalum plate would not relieve convulsive seizures. On the other hand, it was demonstrated that, in patients in whom encephalography did not disclose any definite evidence of cystic or degenerating lesion, the insertion of a plate frequently would relieve the posttraumatic headache which had followed injury of the head.

Convulsive seizures. The frequent occurrence of convulsive seizures following craniocerebral injuries in warfare was the source of a great deal of concern. In determining the prognosis of penetrating wounds of the head, the fact that convulsive seizures could occur weeks, months, or years following the head injury was not forgotten. The British had found that wounds of the scalp of all kinds were followed by convulsions in 24 percent of patients, probably because the underlying injury of the brain was more severe than that which occurs with usual injuries of the scalp in civil life. The British also found that, although convulsions were more certain to follow direct injury to the sensorimotor cortex than injury to some area removed from the rolandic area, the exact site of cortical injury did not seem to have such an important bearing on the production of convulsions. The first seizure might occur within a few hours or as late as 20 years after the original injury, although the onset of the convulsion usually occurred sometime during the first 2 weeks after injury.

Prevention of injuries of the head. For the prevention of craniocerebral injuries, Cairns perfected a protective helmet worn by motorcyclists in the British Army. The regular issue steel helmet worn by the United States soldier and marine furnished excellent protection against craniocerebral injuries, but it had not been designed for the use of the crews in aircraft or tanks and could not be used to advantage by them, mainly because of its size, shape, and weight. Colonel Loyal Davis, MC, A. U. S., designed a close-fitting helmet which was made by molding pieces of acrylic resin to conform to the frontal, temporal, occipital, and vertex portion of the skull. The pieces of acrylic resin were covered with leather and lined with chamois and fleece. Such a helmet allowed for complete movement of the head in all directions, provided complete protection over the frontal and occipital areas, and weighed 18 ounces, compared with the regulation helmet which weighed 35.84 ounces. The helmet which was designed by Davis for the Army

was adopted by marine and naval fliers early in the war and cut down the incidence of craniocerebral injuries.

Blast injuries. A great deal of experimental work was done at the National Naval Medical Center in analyzing the type of wounds produced by blast injuries occurring in the water and determining whether or not protection could be given. In these injuries, cerebral lesions were discovered without any wounds of the head. Cairns believed that the possibility of cerebral fat emboli had to be considered although it was not always found at necropsy.

Naval research on injuries of the head. Another mechanism which acts to injure the brain is the change in velocity of the head following a blow. It was shown experimentally that the velocity behind the blow and the small amount of motion allowed the brain in its closed box was the cause of many cerebral injuries, particularly in patients with closed injury of the head. When the brain lags behind the rotational acceleration forces, a type of shearing strain results. This was demonstrated experimentally at the National Naval Medical Center. Lucite plates were substituted for the calvaria in monkeys, and after the scalp had healed and the brain could be observed under direct vision, blows of differing intensity were applied to the head. Motion pictures made at the rate of 2,000 frames per second showed a definite rotational movement of the brain. Through this lucite cap, also, the brain could be observed when certain gases were injected in the subarachnoid space. The effect of anoxia, the administration of oxygen, and the administration of vasodilating chemicals could also be observed through the transparent acrylic resin cap.

At Princeton University, research on ballistics was in progress, and the lucite plate preparations of monkeys were transported there so that the explosive effect of the bullet could be demonstrated in the brain of the monkey. This experimental work was probably the greatest contribution to neurosurgery during the war because it showed without question the effect of force against the intact skull on the underlying brain and, also, the effect of penetrating missiles of different velocity. This work was reported from the National Naval Medical Research Institute during the war by Craig, Pudenz, and Shelden.

Complications of cranial injuries. The 3 major complications which occur following injuries of the head or operation on the brain are hemorrhage, infection, and edema. The influence of antibiotics in the surgical treatment of craniocerebral injuries was demonstrated by the low percentage of patients in whom an intracranial abscess developed. Advances in the treatment of abscesses also included sterilization of the contents of the abscess, the determination of the safety with which one could wait until the abscess wall was well established, the prevention of ventriculitis and meningitis, and, finally, the successful removal of the abscess in its entirety without the development of widespread encephalitis.

INJURIES OF THE SPINAL CORD

One of the great problems of war was the treatment of patients with spinal cord injuries. Penetrating wounds of the spinal cord, severing the substance of the cord, are followed by complete paralysis below the level of the injury and involve the colon and bladder. The high incidence of broken backs which occur on shipboard and in landing operations is well known. Another type of injury of the spinal cord was concussion caused by the passage of projectiles, not through the spinal cord itself, but in its neighborhood,resulting in the disintegration of the spinal cord. Destruction of the substance of the spinal cord does not respond to any type of surgical treatment, but early in the war it was established that all injuries of the spinal cord should be treated by some type of laminectomy in order to be sure that fragments of bone were not compressing the cord and producing disability. The reason for this was that, even with a small amount of preservation of motion or sensation in the lower extremities, the rehabilitation of the patients was easier and more complete.

In *closed wounds* of the spine, such as a fracture-dislocation of the vertebral column, the application of traction frequently is followed by improvement. In patients with fracture-dislocation of the cervical segment of the spinal cord, it has become a standard practice to apply traction early by means of Crutchfield tongs attached to the skull or by a head harness to extend the neck. Decompressive laminectomy performed weeks or months after spinal cord injuries rarely benefits the patient when evidence of a complete transverse lesion has persisted without a subarachnoid block, but its use should be considered.

The *open wounds* of warfare require meticulous débridement. It was common practice in World War II to remove all bone fragments and to cleanse the wound without opening the dura in the potentially infected field. Indriven spicules of bone and foreign bodies, if accessible, were removed. Dural rents were closed by suture, if possible, or by the application of living fascial grafts in order to stop the leakage of cerebrospinal fluid. The addition of systemic chemotherapy also was of great assistance in dealing with wounds of the spinal cord.

The *nursing* of patients with injury to the spinal cord proved to be quite complicated in view of the loss of control of the bladder and rectum. The use of indwelling catheters and regulated enemas aided in the prevention of decubitus ulcers. Tidal drainage was successfully used in some neurosurgical centers but in others, cystostomy was used to empty the bladder. Drainage by an indwelling catheter, the development of an automatic bladder, and the transurethral section of the hypertrophied sphincter contributed to the rehabilitation of the patients.

Nutrition of the patient was important and the value of a correct concentration of blood protein and a normal albumin-globulin ratio was demonstrated repeatedly. The diet was carefully supervised to provide

a high protein intake and an average daily intake of about 2,800 calories. A high vitamin diet also aided in improving the status of the bladder. The patients were urged to take large amounts of fluids.

The prevention of decubitus ulcers was found to depend on good nursing care. When they occurred, however, in spite of adequate nursing care and nutrition, they were treated with the meticulous care necessary to prevent further infection. Excision of the ulcer and the use of free skin grafts or rotation skin grafts hastened healing.

Vesical problems. The establishment of automatic micturition was one of the chief problems in the rehabilitation of patients with injuries of the spinal cord. The establishment of efficient urinary function was one of the primary goals in the care of these patients. In previous wars, the appalling death rate among the men who had sustained an injury of the spinal cord was caused by urinary sepsis. Although tidal drainage was used extensively in some service hospitals, it required the attention of a doctor, a nurse, and a technician. It was not a simple, self-regulating mechanism, but it did afford a means of continuing cystometric study and assisted in minimizing the bladder infection which tended to occur in spite of medication. It seemed to be the only certain and safe means of retraining the bladder for automatic function.

Various methods of urinary drainage which were used in the early days of the war included (1) allowing the bladder to distend and overflow, (2) manual expression of urine, (3) perineal urethrostomy, (4) suprapubic cystostomy, (5) repeated urethral catheterization, and (6) the use of an indwelling urethral catheter. Under favorable conditions automatic micturition may develop and continue regardless of the level of the lesion, but it develops most rapidly when the lesion is below the seventh cervical segment and above the fifth thoracic segment. In the presence of a lesion of the lower part of the thoracic segment or a caudal lesion associated with contraction of the abdominal muscles, such signs as (1) a feeling of abdominal distention, (2) burning or tenseness in the genitalia, (3) suprapubic cramping sensations, and (4) burning and drawing sensations in the lower extremities, produce an awareness of a full bladder. When the lesion is situated above the ninth or tenth thoracic segment, distention of the bladder and a warning of impending micturition may be manifested by such signs as flushing of the face, arms, and thorax. On becoming aware of such symptoms, many patients are able to initiate micturition by such stimuli as massaging the lower abdominal wall, rubbing the skin of the inguinal region, and tugging on the spermatic cord. Many patients were found to have a greatly hypertrophied vesical neck after the development of an automatic bladder, and transurethral resection of the ring of the hypertrophied muscle was successful in producing a state of automatic micturition with almost complete emptying every 1 to 3 hours.

In observing patients with injuries of the spinal cord, it has been found that automatic micturition will develop after complete severance at any level within the spinal cord or cauda equina. This phenomenon appears earlier and with greater efficiency in the presence of lesions between the seventh cervical and fifth thoracic segments. It does not appear in the presence of incomplete severance of the cord, although the effect of extravesical stimuli on the initiation of micturition may be quite similar in the case of either a complete or a partial severance. Automatic micturition may occur with remarkable regularity at intervals as long as 3 hours but with very low efficiency as determined by a large amount of residual urine. Lesions of the conus medullaris and cauda equina do not produce the striking visceral reflexes such as flushing, perspiring, headache, and reverse peristalsis. Automatic micturition will develop only when there is no mechanical obstruction of the bladder and when the sphincter is capable of reflex relaxation. Automatism will not develop in a patient in whom severe vesical sepsis, multiple calculi, or severe debilitation is present.

Pain in the extremities. Another complication encountered in the rehabilitation of patients with injuries of the spinal cord is the persistence of pain in the extremities. This has been treated in a number of ways, including chordotomy, rhizotomy, and the intrathecal injection of alcohol. The release of abnormal reflex activity has been treated by injection of alcohol and by resection of the motor root. Because each patient is different, no general rules can be laid down regarding the treatment of this complication.

PROTRUDED INTERVERTEBRAL DISKS

One of the perplexing problems encountered by neurosurgeons in the Army and Navy was ruptured nucleus pulposus associated with low back pain and sciatic pain. Because this problem also had been encountered in civil life, an attempt was made to devise a method of treatment that would decrease the number of service-connected disabilities. It soon became apparent, however, that operations for the relief of low back and sciatic pain caused by herniated nucleus pulposus in the different theaters of operation were unsuccessful in most cases and that the patients had to be returned to hospitals in the United States which were equipped to take care of them.

A statistical study which was carried out at the U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md., disclosed that only 62 percent of the enlisted men returned to duty after operations for the relief of pain caused by ruptured nucleus pulposus whereas almost 100 percent of the officers similarly afflicted returned to duty. The operation of choice was a limited type of hemilaminectomy which had been introduced before the war. It was found that a certain percentage of patients who suffered from low back and sciatic pain also had either changes in the bony structure or definite lesions such as spondylolisthesis which contributed to the back pain. The combined opinion of a

neurosurgeon and an orthopedist was obtained with regard to the necessity for fusion following removal of the disk in all these cases. A fusion operation was performed on a certain percent of these patients.

INJURIES OF PERIPHERAL NERVES

The treatment of injuries of peripheral nerves probably showed as much progress as any type of treatment of injuries of the central nervous system. The treatment of injuries of peripheral nerves was aided by experimental research as planned and implemented through the Office of Scientific Research and Development of the National Research Council during World War II. Among the advances which contributed to this progress were (1) Tarlov's work on the use of plasma glue to facilitate the union of nerve ends which could be approximated without tension, (2) the local use of sulfonamides to aid nerve regeneration, (3) the study of the traumatic degeneration produced by the concussive effect of gunshot wounds in which the nerve trunks were not severed, (4) the development of new staining methods to demonstrate the different patterns of nerve regeneration after end-to-end suture, (5) the use of autogenous and homogenous grafts, and (6) the elaboration of electromyographic methods for the study of the denervated and reinnervated muscles.

Electrodiagnosis. One of the most important contributions which was made during the war in the treatment of injuries of peripheral nerves was the observation that a second operation should be performed on patients in whom the injured nerves did not show any evidence of regeneration within 3 months after primary suture. In a large number of patients the second operation disclosed that the ends of the sutured nerves had become separated because of motion or tension. For that reason, certain electrodiagnostic procedures were developed. The changes of response to galvanic stimulation which characterize the complete reaction of degeneration are: (1) hyperirritability of the muscle to galvanic stimuli, (2) sluggishness of the relaxation of the contraction wave, (3) lessening of the ratio between the amperage necessary to produce tetanic contractions and the rheobase to almost unity, and (4) increase in the efficacy of anodal closing stimuli to equality with those of cathodal closure. The practical application of electrodiagnostic methods allowed evaluation of the regeneration at an earlier date than observation. After a sufficient time has elapsed and the characteristics of denervation are not found by electrodiagnosis, the nerve is spontaneously recovering and should not be operated on. If, after a severed nerve has been sutured, the characteristics of the denervated state are not found, it may be assumed with certainty that recovery is taking place. When a sufficient time has elapsed after nerve injury for regeneration to have occurred and the characteristics of denervation are found, the nerve must be operated on. Thus it was that electrodiagnosis was of help in determining on which patients operation should be performed.

Co-operative treatment. One of the great problems in the treatment of nerve injuries was the fact that the injuries of the nerves frequently were associated with injuries of the bones, muscles, and skin. Thus it was apparent early in the war that the combined efforts of the plastic surgeons, the orthopedists, and the neurosurgeons were essential in treating peripheral nerve injuries because, instead of treating the injury of the peripheral nerve itself, the entire extremity had to be treated. This eliminated a great deal of controversy with regard to the use of splints, the application of braces, and the delayed treatment of fractures. The results of treatment of injuries of peripheral nerves were much more satisfactory in the neurosurgical centers where there was complete co-operation between the different departments. The department of physical medicine also played its part in the treatment of injuries of peripheral nerves, the use of passive motion and massage of the extremities contributing to the preservation of function of joints and muscles.

Pathology. The use of new staining compounds which were developed during the war years revealed that mesodermal tissues were the first to react by proliferation after any nerve injury. This proliferation occurs at the site of the lesion and extends into the gap between the severed nerve segments, into the degenerated distal nerve segment, into the perineurium and epineurium of the central segment, and into the distal segment of the nerve. Regenerating nerve fibers follow the path of proliferating histiocytes and collagenous fibers. This observation appeared to be evidence against the generally accepted theory that the regenerating distal segment of the end of a cut nerve exerts a chemotropic influence on regenerating nerve fibers growing out of the end of the central stump. Mesodermal tissue plays a primary role in the organization of autogenous and homogenous grafts in laying down a scaffolding which is followed by regenerating nerve fibers. Depending on the degree of survival of the mesodermal elements in the graft and the degree of necrosis which occurs, this scaffolding follows the original nerve structure, or becomes irregular, deviating, and confused in its course and thus influences the course and the efficacy of the regenerating nerve fibers.

Disintegration in continuity of nerves. One of the most difficult problems in the treatment of peripheral nerve injuries occurred in patients with gunshot wounds in which the continuity of the nerve had not been interrupted. Extensive traumatic injury was found in the nerves at the site of the trauma and injuries of peripheral nerves frequently were evident in patients in whom the missile had not penetrated the nerve but had passed through the adjacent tissue. It was difficult to realize that definite degeneration of long segments of a nerve could take place, both centrally and peripherally, as a result of this type of injury.

Nerve suture. Young and Medewar, in England, and Tarlov, in this country, carried out a series of experiments by using concentrated

blood plasma gel to unite the ends of divided nerves. This method of repairing nerves was put to a practical application in the U. S. Naval Hospital, St. Albans, N. Y. This method was used in a series of cases, and, at the same time, suture with silk, nylon, or tantalum wire was used in another series of cases. Experiments on the use of different types of sutures were carried out at the National Naval Medical Center. It was found that those sutures which caused the least reaction in peripheral nerves were human hair, nylon, silk, and tantalum wire. The use of catgut was not advised because of the marked reaction of the nerve cells about the suture.

Causalgia. One of the great problems in treating injuries to extremities was the painful syndrome which had been called "causalgia." Causalgia and the pain of phantom limb were similar, and operations on the sympathetic nervous system with denervation of the affected limb was followed by relief of pain in a high percent of patients.

A NEUROSURGICAL HEADREST

The technic of certain neurosurgical operations has been standardized by placing the patient in a sitting or upright position. In some clinics, dental chairs were converted for use in these procedures; in others, elaborate appliances were constructed which could be attached to the operating tables, or various special tables were designed for this purpose. Shortly after the beginning of the war, it became apparent that the hospitals of the Armed Forces needed an attachment that could be applied to an ordinary operating table. From a practical standpoint, this attachment had to be inexpensive, relatively small, and had to combine certain essential features that could be universally used by the Army as well as the Navy. At the Naval Medical Center, Bethesda, Md., such an apparatus was designed and a rough model was tried. It proved valuable for operations on the brain and cervical portion of the spinal cord.

Removal of cerebellar tumors, resection of the acoustic and glossopharyngeal nerves for Ménière's disease and glossopharyngeal neuralgia, hemilaminectomy in the cervical region of the spinal cord for protruded intervertebral disks and tumors, and various other operations about the neck and head have been facilitated by having the patient in the upright position. The escape of blood and cerebrospinal fluid by gravity leaves the operative field clean and the exposure unobstructed. This upright position has been used almost universally for the section of the trigeminal nerve for the relief of trigeminal neuralgia. Certain other operations on the parietal and temporal region of the head can be performed with greater ease if the patient is in this position.

One of the great objections to the use of the upright position for neurosurgical operations has been the variations which occur in the blood pressure during the operation and the necessity of lowering the head of the patient in the course of the surgical procedure. The head-

rest in question obviated this danger as the patient could be placed in the sitting position with the feet elevated to the level of the head. As a further precaution it was found that splinting the vascular bed of the lower extremities had a most profound stabilizing effect on the blood pressure. If the legs were wrapped in ordinary bandage of one thickness from the ankle to the groin, even when the operation was performed under general anesthesia, the blood pressure would not vary unless there was an extraordinary loss of blood in the course of the operation.

The headrest consists of a bar which can be attached to the stirrup rods which are standard equipment of the operating table. To this bar is attached a movable and adjustable headrest in which the head can be fitted in almost any position for suboccipital operations, ventricular drainage, and cervical laminectomy. For the lateral approach, the head can be adjusted so that a proper exposure of the temporal or parietal area can be obtained. The entire apparatus was so constructed that the patient could be in the center of the table for a posterior approach or could be placed to the right or left of the midline for temporal or parietal operations.

A NEUROSURGICAL FLYING UNIT

The limited number of adequately trained neurosurgeons made it important that they be used wisely. The Surgeon General of the United States Navy was cognizant of this fact and suggested the formation of a flying neurosurgical unit to be stationed at the National Naval Medical Center, Bethesda, Md. This unit was authorized in July 1942. It was to be ready to answer emergency calls along the East Coast during a possible token bombing by the enemy. The Surgeon General realized that adequate operations on the brain, peripheral nerves, and spinal cord require certain special equipment which is not available in all service hospitals. He also realized the importance of a trained surgical team consisting of surgeon, assistant surgeon, anesthetist, nurses, and hospital corpsmen.

Experiences had shown that, in the management of injuries of the brain and spinal cord, transportation of the wounded to the nearest hospital where adequate care was available resulted in a lower mortality rate and a more satisfactory convalescence. Because it was realized that bombing of the Atlantic coast might result in a great number of injuries to the central nervous system at a place where adequate neurosurgical care was not possible, this flying neurosurgical unit was maintained throughout the war to augment the staff and equipment of the hospitals along the coast in an emergency. Such a unit with all necessary equipment had, by necessity, to be transported by air to any point where urgently needed. This would not only assure specialized surgical care in widely separated areas, but would greatly reduce the need of a complete neurosurgical team in every hospital where these injuries might have to be treated.

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The neurosurgical flying unit which was developed at the National Naval Medical Center consisted of a neurosurgeon, an assistant neurosurgeon, an anesthetist, and a hospital corpsman. The entire equipment was so assembled that the four men comprising the team could transport it from the hospital to the flying field in a station wagon or ambulance, carry it to the plane, and arrange for transferring it to the hospital where needed. A small portable electrosurgical unit, a fiber case for neurosurgical instruments, a small portable suction unit, and a portable operating table were procured. Suitable carrying cases were needed for the towels, sheets, gloves, pans, gowns, and gauze. These carrying cases were, of necessity, light and easily handled. For this purpose, marine sea bags on which handles were sewn were procured. A list of the contents of these bags was typed on linen, and sewn on the flaps so that the bags could be taken to the central supply room and filled when needed. Articles were checked as they were put in.

Six marine bags were found to be sufficient for transporting the necessary supplies and they were light enough to permit them to be carried by hand. The supplies contained in the marine sea bags—the electrosurgical unit, the suction apparatus, the fiber case of neurosurgical instruments, and the portable operating table—proved to be sufficient for emergency neurosurgical procedures to be performed either in an equipped operating room or in an emergency room, in a schoolhouse or in temporary hospital quarters, and the transportation of this entire unit by plane to any part of the country was possible. Forty minutes after the unit was alerted, the instruments could be sterilized, the supplies assembled, and the unit could be on the way to the airport. In similar bags were transported all necessary solutions such as plasma, serum albumin, saline solution, and pentothal sodium along with equipment for giving fluids intravenously. Four medical kits containing all necessary incidental items for proper surgical care were also included. The weight of these items is shown in table 1.

TABLE 1. *Weight of equipment*

1 first aid kit	12½ pounds
1 suction apparatus	23 pounds
1 fiber case of instruments	73 pounds
1 operating table	87 pounds
1 electrosurgical unit	70 pounds
1 first pack	50 pounds
1 second pack	52 pounds

This flying neurosurgical unit was evidence of the foresight and planning of the Bureau of Medicine and Surgery to meet any emergency which might arise in a global war. It was available at all times and was so equipped that any type of neurosurgical problem could be promptly and adequately treated regardless of the local condition encountered.

COMMENT

No history of any period is complete without a comment on the mistakes which have been made. Among the mistakes which were made

during World War II was the immobility of the surgical specialists. It stands to reason that during peacetime the number of surgical specialists needed to take care of civilians is not as great as it is during time of war. In the tables of organization of naval hospitals, hospital ships, and dispensaries, the surgical specialties, particularly the specialty of neurosurgery, should be eliminated and neurosurgical teams and consultants should be mobile. Although it is difficult to determine the incidence of injuries to the central nervous system during World War II, a few reports have indicated that the central nervous system is involved in about 10 percent of all casualties. It stands to reason then that it is a waste of time and talent to immobilize a neurosurgeon to take care of 10 percent of the wounds which come to a naval hospital. It might be well to create neurosurgical teams which could go about wherever they are needed and be available as indicated. The mobility of the neurosurgeons in setting up the table of organization for another world war should certainly be encouraged—or at least the neurosurgical consultant in a certain area should be responsible for the neurosurgical activity in certain hospitals. Only in this way will it be possible to take care of the neurosurgical wounds satisfactorily and to supervise the rehabilitation of patients suffering from injuries of the central nervous system.

SUMMARY

Neurosurgery is a specialty of surgery requiring a background of fundamental knowledge of general surgical principles, of neurology, and of the allied specialties of ophthalmology and roentgenology. During World War II the many advances in these fields contributed greatly to the better care of neurosurgical patients. The use of antibiotics greatly reduced the incidence of infection and allowed for primary closure of wounds. The use of plasma early in the treatment, followed by transfusions of whole blood, played its part in the healing of wounds. Particular attention to water balance, electrolytes, balanced intake of protein and a high protein maintenance diet, the administration of vitamins, good nursing care, and careful attention to the cleansing of wounds all played a part in the successful treatment of neurosurgical wounds in World War II.

Major advances in neurosurgery included the introduction of such hemostatic agents as fibrin foam, oxycel or oxyiodized gauze, which was absorbed, and gelfoam. There were advances in the repair of cranial defects and considerable research was done on head injuries. The importance of performing some type of laminectomy on patients with injury of the spinal cord was established and there were new developments in methods of initiating efficient vesical function to avoid urinary sepsis. Good nursing care in these cases was recognized to be of extreme importance. Much progress was made in the treatment of injuries of peripheral nerves, among them the use of plasma glue for uniting divided ends of nerves, the development of sutures which were neutral and did not create reaction on the part of the tissues, and the use of electrodiagnostic methods.

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BOOK REVIEWS

Chest X-ray Diagnosis, by *Max Ritvo,* M. D., Assistant Professor of Radiology, Harvard Medical School; Instructor in Radiology, Tufts Medical School; Roentgenologist-in-Chief and Director, Department of Radiology, Boston City Hospital; Associate Radiologist, Beth Israel Hospital, Boston, Mass.; Radiologist, Jewish Memorial Hospital, Jewish Tuberculosis Sanitorium of New England, Revere Memorial Hospital, and Hudson Hospital. 558 pages; 615 illustrations. Lea & Febiger, Philadelphia, Pa., publisher, 1951. Price $15.

This comprehensive compilation of the diseases affecting the thoracic organs, with descriptions of their roentgen manifestations and with discussions of diagnostic criteria, is divided into the following sections: (1) the lungs; (2) the mediastinum; (3) the diaphragm; (4) the pleura; (5) the bony thorax and the soft tissues of the chest wall; (6) the soft tissues of the neck; (7)the heart and great vessels; (8) the aorta; (9) the pulmonary artery; and (10) the pericardium. The subject is well organized. The writing is clear and concise. Pertinent clinical data regarding the various disease entities are included. It is pleasing to note that all roentgenograms are reproduced as negatives and that almost all of the reproductions are of good quality. This volume is handsomely printed and well bound. It is a pleasure to read. The work is a worthwhile addition to the library of the student of roentgen diagnosis and the author and publisher are to be congratulated on its excellence.

—*Capt. C. E. Bentel, MC, U. S. N.*

Pediatric Allergy, by *Robert Chobot,* M. D., Assistant Clinical Professor of Pediatrics, New York University-Bellevue Medical Center; Director of the Pediatric Allergy Clinic, University Hospital of New York University-Bellevue Medical Center; Consultant in Allergy, Downtown Medical Center; Assistant Physician, Allergy Clinic, Roosevelt Hospital. 284 pages; illustrated. McGraw-Hill Book Co., Inc., New York, N. Y. Price $4.50.

This small well-written volume describes in detail the diagnosis and treatment of allergic diseases of children. The emphasis is definitely on the clinical aspects of the subject with only the first short chapter devoted to the experimental and historical aspects of allergy. The author most eloquently states his opinion regarding the importance of foci of infection in causing every kind of allergic disease in childhood, while admitting that this subject of so-called "infective" allergy is controversial and not emphasized by many allergists. The usual allergic respiratory diseases are well covered and, in addition, drug allergy, migraine, allergy of the eye, and allergic skin diseases are briefly reviewed. The probable eventual limited uses of ACTH and cortisone are indicated.—*Col. W. H. Diessner, MC, U. S. A.*

Psychoneuroses

Military Applications of a Follow-up Study (1)

Norman Q. Brill, *M. D.*

Gilbert W. Beebe, *Ph. D.*

FOR the past several years a follow-up study of military psychoneuroses has been conducted. Following the outbreak of hostilities in Korea, we were requested by the Chief of the Research Division, Veterans Administration, to review our findings to determine their possible military application. After consultation with the Chief of the Psychiatry and Neurology Consultants Division, Office of the Surgeon General, Department of the Army, it was decided to examine our data from the standpoint of the existing induction policy regarding psychoneuroses. In addition, we studied the possible applicability of the data to utilization and discharge policies because these are inevitably linked with the induction policy.

The emotional health of a person and the nature of his adjustment in civil life can be determined fairly readily (although not very accurately) from a relatively brief psychiatric interview. We, therefore, studied these items in our data to learn to what extent knowledge of them in any given case would be of help in deciding for or against induction, for or against return to duty if hospitalized, and the method of discharge if return to duty was not possible. We attempted to relate military performance and condition on follow-up several years later to such factors as: (1) preservice personality (in terms of degree of emotional disorder); (2) impairment in general functioning before entry into service; and (3) preservice adjustment in such areas as school, work, family, and sex.

PROCEDURE

The study consisted essentially of three phases. The *first* phase was the selection of a representative sample of Army and Navy enlisted

(1) From the Department of Psychiatry, George Washington University School of Medicine. Dr. Winfred Overholser, Professor of Psychiatry and head of the Department, was the responsible investigator. The study was supported by a contract with the Veterans Administration and constitutes part of the cooperative program of follow-up studies developed by the Committee on Veterans' Medical Problems, National Research Council, and the Veterans Administration with the aid of the Army and Navy.

men treated for a psychoneurosis (with loss of at least 1 day of duty) in World War II *(2)*. Men who were treated solely on an outpatient basis were excluded. The sample consisted of 290 Navy and Marine Corps personnel admitted for psychoneurosis during the period 1942 to 1945 and 665 Army enlisted men admitted in 1944. The *second* phase consisted of the examination, by selected psychiatrists throughout the country, of as many of the men as would cooperate. The follow-up interval averaged about 5 years between treatment for psychoneurosis in the service and re-examination in civil life. Sixty-two percent were examined by psychiatrists and for the rest information was obtained from military and Veterans Administration medical and personnel records, Red Cross social histories, other Red Cross reports, and questionnaires. The *third* phase embodied coding, tabulation, and analysis of the details of family history, preservice personality and adjustment, military stress, military career, nature of the breakdown, treatment received, condition on discharge from the service, treatment and course of illness since service, condition and adjustment on follow-up, attitudes toward illness and military service, compensation received for illness, and prognosis.

TABLE 1. *Distribution of patients by preservice personality*

Preservice personality	Distribution	
	Number	Percent
Well integrated	122	14.2
Neurotic traits	292	34.0
Suggestive neurosis	140	16.3
Overt neurosis	125	14.6
Pathologic personality*	172	20.0
Latent or overt psychosis	3	0.4
Posttraumatic syndrome, organic	4	0.5
Subtotal	858	100.0
Unknown	97	
Total	955	

*Includes 36 patients (3.8 percent) with behavior disorder.

RESULTS

Preservice personality

Each patient was classified as to preservice personality. The categories used and the distribution of patients are indicated in table 1. The classification was not that which was established when the pa-

(2) For convenience, the loss of time from duty will be referred to hereafter as "breakdown. In some instances hospitalization was the result of chronic inability to adjust in the service with no significant change in the type or severity of symptoms, whereas in others it followed a sudden decompensation.

tient was inducted. It is believed that if the information on which the classification was based had been available to the psychiatric examiner at the time of induction, the same evaluation could have been made. The information, largely provided by the men themselves during a 1- to 4-hour interview, is in all probability at least as reliable as that which can be obtained in an induction examination. It might be expected that at follow-up men might be prone to minimize any difficulty they had prior to service, and that during service they might have exaggerated it. Where discrepancies were seen, an attempt was made to evaluate and combine the information from both periods.

Significant relationships were found between preservice personality and all the indexes of military usefulness which we selected for study, namely: (1) total length of service, (2) percent serving overseas, (3) average length of overseas service, (4) admission rate, (5) court-martial rate, (6) incidence of awards and decorations, including Purple Heart, (7) length of service prior to breakdown, (8) MOS at time of breakdown, (9) mission of unit at time of breakdown, (10) admission rate prior to breakdown, (11) major area of stress precipitating breakdown, (12) location (in military career) at time of breakdown, (13) duration of combat prior to breakdown, (14) severity of stress prior to breakdown, (15) length of service after breakdown, (16) type of separation from service, (17) admission rate after breakdown, (18) disposition from hospital, and (19) quality of duty performed after breakdown. The numerical values of these indexes are shown in table 2 for each personality group.

Performance

1. *Overtly neurotic group.* The average length of service before breakdown was 13.2 months. During this time 80 percent of the Army and Marine Corps veterans had either been assigned or already reassigned to a relatively nondangerous MOS and 20 percent had dangerous MOS's (3). That an overt neurosis prior to entering the service was not always associated with early breakdown is shown by the fact that 18 percent did not break down until exposed to the stress of combat. Those who reached combat remained for an average of 4.1 months in combat before they broke down (not significantly different from the other groups). A breakdown in a person with a pre-existing overt neurosis did not necessarily result in medical discharge. Although this group did not render very effective service after breakdown, only 70 percent were ultimately discharged for psychoneuroses.

Fifty-seven percent were medically discharged without ever returning to duty after the first hospitalization. At the other extreme, 10 percent returned to duty without reassignment. How many of these were already in nondangerous and in dangerous assignments has not yet been deter-

(3) Riflemen, gunners, and men assigned to intelligence, reconnaissance and security work were considered to have dangerous MOS's; assignments in communications, transportation, supply, maintenance, medical, construction, technical, and administrative work were considered relatively nondangerous.

TABLE 2. *Military performance of preservice personality groups*

	Normal	Neurotic traits	Suggestive neuroses	Overt neuroses	Pathologic personality
Total period of military service					
Mean months of service	36.1	31.7	22.6	21.8	32.8
Percent serving overseas	85.7	76.6	43.9	32.4	69.1
Mean months overseas	18.1	12.7	6.8	5.5	12.2
Admissions per 1,000 men per year, all causes	1,086	1,229	1,340	1,482	1,484
Admissions per 1,000 men per year, psychoneurosis only	428	461	642	756	490
Courts-martial per 1,000 men per year, all causes	68	66	72	71	214
Percent receiving Purple Heart	18.0	15.1	3.6	1.6	10.5
Percent receiving other awards and decorations	9.0	7.5	2.1		1.2
Period prior to breakdown					
Mean months of service	23.6	22.5	14.1	13.2	23.8
Percent with dangerous MOS at breakdown	46.8	49.8	34.3	20.2	38.1
Percent assigned to combat units at breakdown	68.8	62.2	41.9	32.1	44.8
Admissions per 1,000 men per year, all causes	696	826	825	936	1,069
Percentage breaking down under no stress	1.0	1.2	9.4	12.6	8.6
Percentage breaking down under no or mild stress	32.1	41.3	74.3	83.7	53.9
Percentage breaking down under combat stress	69.5	58.4	27.1	17.9	47.5
Percentage breaking down prior to overseas shipment	18.9	21.7	57.7	62.3	33.9
Mean months of ground combat of men with combat experience	3.28	2.32	2.74		3.51
Period after breakdown					
Mean months of service	12.6	9.3	8.4	8.6	9.0
Percent with medical discharge for psychoneurosis	38.5	57.5	57.1	69.6	61.6
Admissions per 1,000 men per year, all causes	854	906	781	926	1,254
Percent returned to duty without reassignment	26	14	13	10	13
Percent with good and continued service, if returned to duty	31.9	24.7	17.6	13.0	13.8

mined. The average length of service after breakdown was 8.6 months (of which about 2 months were spent in hospitals). The admission rate for all causes was essentially the same as before breakdown. The admission rate for entire period of service (1,482 per 1,000 men per year) was more than double the average rate for the Army and Navy for the war period.

2. *Well-integrated, normal group.* The performance of the normal group differed markedly from that of the overtly neurotic. Four times as many broke down in combat; nearly 3 times as many served overseas; nearly 3 times as many were returned to duty after breakdown; and the average length of overseas service was 3 times as great. In 70 percent the major area of stress was combat and 46 percent broke down in combat after an average of 3.3 months in combat. The incidence of combat for the normal group was much higher than that for the Army and Navy as a whole, reflecting the fact that it is combat, in very large part, which precipitates breakdown. It is highly probable that this normal group was composed of different types of persons who were indistinguishable at induction. At one extreme were those with a latent neurotic difficulty, who, like the majority in the neurotic group, break down under the relatively mild stress of military training and service in the zone of the interior; and at the other extreme were the relatively stable persons who "break" only under the severe stress of combat.

Twenty-one percent were medically discharged without being returned to duty. At the other extreme, 26 percent were returned to duty without reassignment. The group served an average of 12.6 months after breakdown, roughly 1.5 months of which were spent in hospitals.

3. *Groups with neurotic traits and suggestive neuroses.* In almost all respects the performance of these groups fell between that of the normal and overtly neurotic group, the group with neurotic traits approximating the performance of the normal group and those with suggestive neuroses approximating the performance of the overtly neurotic group.

4. *Group with pathologic personalities.* This group (which includes but is not confined to those with behavior disorders) showed variable performance in comparison with the other groups. By most criteria (percent serving overseas, average length of overseas service, Purple Heart awards, combat, severity of stress, and length of service after breakdown) its performance fell between that of men with neurotic traits and that of men with suggestive neuroses. With respect to total length of service, length of service before breakdown, and average time in combat (for those who were in combat), they resembled the normal group, but they showed the highest admission and court-martial rates, the latter being 3 times as great as those of the other groups. Part of the difference in relative frequency of courts-martial is associated with the poorer educational status of this group. In general the court-martial rate decreases as the educational level increases.

TABLE 3. *Distribution of patients by degree of preservice psychiatric impairment*

Psychiatric impairment	Distribution	
	Number	Percent
None	395	51.1
Questionable	118	15.3
Mild	169	21.8
Moderate	81	10.5
Marked	10	1.3
Subtotal	773	100.0
Unknown	182	
Total	955	

Preservice psychiatric impairment and adjustment

In addition to the evaluation of preservice personality, an estimate was made of the extent to which there was impairment in general functioning, with ability to work being used as the chief criterion. Impairment was partly revealed by the personality evaluation. A normal, well-integrated personality or suggestive neurosis presupposed an absence of impairment. An overt neurosis implied some impairment. The distribution of the sample by degree of preservice psychiatric impairment is shown in table 3. Preservice adjustment was considered in each of the following areas: family, sex, school, work, social and recreational life, community, and marriage. It was then summarized in a single judgment, as shown in table 4. Tabulations were made which paralleled those used in exploring the predictive value of the preservice personality.

TABLE 4. *Distribution of patients by summary of preservice adjustment*

Preservice adjustment	Distribution	
	Number	Percent
Satisfactory (adequate or better) in all areas	178	21.2
Questionable in one or two areas, none impaired	184	22.0
Questionable in three or more, or impaired in one or more areas	476	56.8
Subtotal	838	100.0
Unknown	117	
Total	955	

Significant relationships were found but in no instance were they greater than those obtained with preservice personality, and in most instances they were not as great. It seemed quite clear that, of the 3 major preservice characteristics studied (preservice personality, impairment, and adjustment), personality was the most valuable predictive factor.

Predictive value of combinations of preservice personality with other items

Attempts were made to determine whether any other summary factor could be added to preservice personality in order to improve predictions of military effectiveness. Generally negative results were obtained, with the following exceptions:

1. None of those having both an overt neurosis and a moderate or marked impairment at entry into service, and returned to duty after breakdown, gave effective service thereafter. This was in contrast to 22 percent for men with an overt neurosis but whose impairment was only mild.

2. There was a suggestion that a previously well-integrated person, with a family history not known to be positive in the psychiatric sense, was returned to duty without reassignment more frequently than one with a poor family history.

3. When the patient's evaluation of his own health *(4)* on entry into the service was considered together with preservice personality, improved prediction resulted for those two areas of performance which were studied. Only 15 percent of the normal group and those with neurotic traits, who said their health at entry was excellent, broke down in the zone of the interior, in contrast to 37 percent in these personality-groups who said their health was less than excellent. The average percent with breakdown in the zone of the interior, regardless of their health evaluations, was 19 for the normal group and 22 for those with neurotic traits. Again, when each personality group was divided into those who reported their preservice health as excellent and those who said it was less than excellent, and these two subgroups were compared as to major area of precipitating stress, better prediction was obtained than with preservice personality alone. Table 5 summarizes the data on each group. When the man's own evaluation of his health at entry was used to subdivide the well-integrated group it was found that the rate at which those who said their health was less than excellent broke down in combat approximated that of the neurotic group. Similarly, by subdividing the overtly neurotic group, men with a distinctly better military prognosis could be isolated. Of those who said their health was excellent, 38 percent broke down in combat in contrast to 12 percent who said their health was less than excellent.

(4) This is the man's reply (on follow-up) to the direct question "How was your health when you entered the service?" It was possible for a man to claim his health was excellent and be classified in the overtly neurotic group. Similarly a man classified as well-integrated could have stated that his health was less than excellent.

More accurate prediction of military effectiveness was possible when a man's own evaluation of his health on entering the service was considered in conjunction with an objective appraisal of his emotional status. Further study along these lines should be fruitful. It is likely that the man who considers himself ill has, to a greater extent than the one who does not, accepted his emotional difficulty as a limitation and adjusted himself to a lower level of activity. The man who tends to deny his difficulty or not accept it as a limitation is apt to show greater resistance to stress up to a point. So far, there is nothing to indicate that this latter man is sicker when he does decompensate in a military setting.

TABLE 5. *Percent of patients having combat as major area of precipitating stress, by preservice personality and declared health on entry into the service*

Preservice personality	Declared health on entry		
	Excellent	Other	Total
Well-integrated and adjusted	76*	30*	70
Neurotic traits	62	52	58
Suggestive neurosis	26	26	27
Overt neurosis	38*	12*	18
Pathologic personality	51	33	47

*Horizontal differences between paired percentages are statistically significant at the 5 percent level, the others not. For all personality groups combined, the evidence is that declared health at entry provides additional information.

Follow-up status

From a narrowly military standpoint, what happens to a man after he has been discharged may be of no great consequence, but because decisions about induction policies are partly premised on the need to minimize the national economic and medical burden of disability, the status of the sample at re-examination after about 5 years is of interest. Each of the summary preservice factors was examined in relation to the major indexes of follow-up status.

1. *Follow-up status in relation to preservice personality.* The various criteria of follow-up status and the results obtained with each are shown in table 6.

a. Psychiatric disability. Relative disability at follow-up differed significantly among the various preservice personality groups. Five times as many of the overtly neurotic and 6 times as many of those with pathologic personalities were found to have at least moderate disability as compared to the normal group.

b. Adjustment summary. Over twice as many of the overtly neurotic group and 3 times as many of the pathologic personality group showed some impairment in general adjustment at follow-up as compared to the normal group.

TABLE 6. *Follow-up status of preservice personality groups*

Follow-up status	Normal	Neurotic traits	Suggestive neuroses	Overt neuroses	Pathologic personality
Percent with at least moderate disability at follow-up	7.9	24.4	20.9	39.4	50.3
Percent with impaired adjustment at follow-up	26.3	50.2	38.0	61.9	73.5
Percent with illness more severe than mild psychoneurosis (including pathologic personality)	10.7	35.2	29.7	50.0	66.5
Percent drawing no disability compensation	54.6	42.2	66.7	58.8	49.4
Percent with poor prognosis	8.0	20.1	19.3	41.1	47.8

c. Psychiatric diagnosis. The specific psychiatric diagnosis at follow-up can be expected to parallel the degree of disability to a great extent because a quantitative element is included in the diagnosis (mild, moderate, severe). Nearly 5 times as many of the overtly neurotic group and 6 times as many of the pathologic personality group were diagnosed as having more than a mild psychoneurosis as compared to the normal group.

d. Disability compensation. Forty-seven percent of the men in the sample were drawing disability compensation. There is no more than a suggestive relationship between preservice personality and disability payment.

e. Examiner's prognosis. Five times as many of the overtly neurotic group and 6 times as many of the pathologic personality group had a distinctly unfavorable prognosis (without the possible effect of treatment being considered) as compared to the normal group.

TABLE 7. *Follow-up status of preservice impairment groups*

Follow-up status	None	Questionable	Mild	Moderate or marked
Percent with at least moderate disability at follow-up	18.0	27.8	36.2	63.9
Percent with impaired adjustment at follow-up	41.3	50.0	61.0	77.2
Percent with illness more severe than mild psychoneurosis (including pathologic personality)	29.0	39.5	45.9	74.7
Percent drawing no disability compensation	47.7	56.8	52.1	51.8
Percent with poor prognosis	17.1	25.9	33.6	64.3

2. *Relation to preservice impairment and adjustment.* The above measures of follow-up status were also related to preservice impairment and adjustment. The latter were found to be significantly associated with psychiatric disability and prognosis on follow-up, especially preservice impairment, but not to any greater degree than preservice personality. Somewhat similar findings were obtained when adjustment and psychiatric diagnosis on follow-up were compared with preservice impairment and adjustment. Disability compensation seems unrelated to either preservice impairment or adjustment (tables 7 and 8).

TABLE 8. *Follow-up status of preservice adjustment groups*

Follow-up status	Satisfactory	Questionable	Impaired
Percent with at least moderate disability at follow-up	10.7	26.2	38.7
Percent with impaired adjustment at follow-up	23.5	42.9	66.7
Percent with illness more severe than mild psychoneurosis (including pathologic personality)	16.7	32.2	53.0
Percent drawing no disability compensation	49.7	51.6	52.6
Percent with poor prognosis	9.5	17.8	38.7

3. *Effect of type of disposition (medical or nonmedical) on follow-up status.* An attempt was made to determine whether the type of disposition per se had any effect on the course of illness after discharge. Two disposition groups were established, one for disability discharges and the other for men returned to duty. These were then matched on the following characteristics: (a) severity of first illness in service; (b) preservice personality and impairment; and (c) major area of stress causing breakdown. This possibility was explored because of the hypothesis that a man who is discharged via medical channels as disabled may have to contend with the psychologic factor of being considered sick (including the temptation of secondary gain of illness) and therefore may not do as well as a similar man who is returned to duty and later discharged administratively. The results of studying groups which were matched only for the above characteristics left many other variables, such as condition on discharge and treatment since discharge, uncontrolled and the results were consequently only suggestive.

The men who were discharged for disability were somewhat more disabled at follow-up than those who were returned to duty and later discharged for the convenience of the government, but statistically the findings were suggestive rather than significant. The two groups differed significantly as to psychiatric diagnosis at follow-up, those returned to duty having a clear advantage (table 9). If a man were returned to duty without subsequent medical discharge, his chances of *not* being ill at follow-up appear to be about twice as great as one who was medically discharged on psychiatric grounds. It was also found that those

who were medically discharged were much more apt to receive disability compensation, but this fact does not in itself indicate that these men were any sicker on follow-up. As suggested above, it may be that those who were medically discharged were the ones who did not improve with treatment after their breakdown and consequently were sicker when they were discharged, emotionally sicker on follow-up (though not significantly more disabled), and therefore received compensation much more frequently. Medical discharge in itself may have been a factor and further study of the problem is indicated.

TABLE 9. *Percentage distribution of patients by diagnosis at follow-up for two groups differing as to disposition from hospital but matched on other determinants* of prognosis*

Psychiatric diagnosis at follow-up	Disposition from hospital	
	Duty (150 men)	Medical discharge on psychiatric grounds (162 men)
Not ill	41	19
Psychoneurosis, mild	31	39
Psychoneurosis, moderate	13	27
Psychoneurosis, severe	4	4
Other (personality disorder, psychotic reaction, et cetera)	11	11
Total	100	100

*Determinants chosen were severity of illness in service, preservice personality, preservice impairment, and major area of precipitating stress.

Effect of treatment in the service

In order to study the effect of treatment received after breakdown, treatment groups were matched on the basis of preservice personality, preservice impairment, severity of first illness in the service, and type of precipitating stress. The type of treatment (hospital routine, individual therapy, and essentially none) was then correlated with ultimate disposition (certificate of discharge for disability or duty), the quality of any subsequent duty, emotional health on separation from the service, and follow-up status. Within this framework the type of treatment in service had no demonstrable effect on any of the indexes of subsequent performance or health status in the service and at follow-up. This does not necessarily mean that treatment had no effect. It suggests that there was little or no difference in the effects of the various types of treatment or that the groups were inadequately matched.

DISCUSSION

Induction policy. In the early period of mobilization for the last war, it was hoped that the psychiatric problem of World War I could be avoided by careful screening at induction and the elimination of those

with emotional difficulties. Despite high rejection rates for psychiatric disorders, large numbers of men with emotional difficulties of all severities kept turning up. At first the policy was to discharge them, but as the discharges increased the incidence of such disorders also seemed to increase. Later in the war, when there was a serious threat of manpower shortage (1) the standards for induction were lowered, (2) some men were taken in who previously would have been discharged, and (3) serious efforts were made to use limited service as well as general service personnel as effectively as possible. At times men with neurotic disorders could not be sent overseas; at other times they were.

Combat experience showed fairly consistently that for every 5 men wounded there would be about 1 psychiatric casualty. Men who had seemed well-adjusted emotionally broke down under the stress of combat and others who were known to have neurotic disorders did well. It seemed fairly clear that, except in obviously severe cases, reliable prediction concerning any one man's performance was not possible. The importance of such things as training, leadership, motivation, suitable assignment, and expectation of relief was recognized in relation to a man's ability to withstand emotional stress. This observation contributed to the establishment of a different concept of induction than existed at the beginning of the war: that only those men with neuroses which were already grossly incapacitating should be excluded and the remainder inducted. Only those who clearly demonstrated an inability to adjust in the service would be discharged. This policy is still in effect.

Our findings seem to support such a policy, for a large or total mobilization. Although not designed to contribute to such military problems as induction, utilization of manpower, and disposition of men hospitalized for psychoneuroses, the study does permit limited general conclusions to be drawn in these areas. The principal limitations of the study in this regard are:

1. All of the men in the sample were treated for psychoneuroses in the service. Conclusions which would be applicable to men presenting themselves for induction or to the general Army population are necessarily indirect.

2. The findings must be considered in relation to utilization and discharge policies which existed in World War II. It is not possible to state with certainty what effect other policies might have had.

3. Data on military performance were gathered from the standpoint of correlation with follow-up status. No explicit attempt was made to assess total military effectiveness as such.

Whereas in many criteria of military effectiveness those who were overtly neurotic prior to entering the service did poorly when compared to those who broke down but had been previously well-integrated, the neurotic group was by no means a total loss. It is true that all of these

men passed through an induction screening and as such were probably not as sick as, or were differently motivated from, others with overt neuroses who were rejected. Had there been no elimination of men with overt neuroses at induction, the percentage of such men in our sample would undoubtedly have been higher and the general military performance of the sample poorer, but it must be remembered that all men with pre-existing neuroses did not break down in the service. If it is postulated that only 50 percent of them did, and if the performance of those who did not break down could be averaged in with the sample studied, it would be seen that overt neurotics generally did much better than those included in this study sample.

Thirty-two percent of the neurotic group were able to complete their training and serve overseas for an average of 17 months before breakdown. In 18 percent, breakdown was the result of combat stress. Thirty percent completed their military service and were demobilized (without being medically discharged for psychoneuroses). There is no test which can equal actual trial at duty in differentiating those with good from those with poor prognoses, especially since one man may do well in one situation with a given commanding officer and branch of service and do poorly in another, whereas it might be just the reverse with another man. The performance of those with suggestive neuroses and neurotic traits on entry into the service was much better, with the latter group in some respects approximating the normal group.

The proportion of men in the service with pathologic personalities and suggestive neuroses who broke down is perhaps 15 to 25 percent smaller than that of the neurotic group so that the extent to which our figures are biased by confinement to just those who broke down can be seen. Any attempt to eliminate at induction all men with neuroses or pathologic personalities would be extremely wasteful, even if possible.

If it is assumed that all of the men who broke down were not induction errors (and this cannot be the case because the sample consisted of men with all gradations of emotional stability), then the problem of induction standards can be approached via this question: "What increase in the rigidity of psychiatric standards could have minimized the rate of breakdown in the service?" If the entire Army population during the war (about 12,000,000 men) could have been classified as to preservice personality, as was done with our sample, some such breakdown as is shown in table 10 might have resulted.

If, on the basis of the distribution of our sample, the 600,000 different men who were admitted one or more times for psychoneuroses during the war were classified as to preservice personality, the results shown in table 11 would have been obtained.

In order to eliminate those with suggestive and overt neuroses and those with pathologic personalities, who made up about 50 percent of all those who broke down, it would have been necessary to eliminate

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TABLE 10. *Possible preservice personality figures for entire Army population*

Preservice personality	Frequency distribution	
	Number	Percent
Well-integrated	7,800,000	65
Neurotic traits	2,760,000	23
Suggestive neuroses	360,000	3
Overt neuroses	120,000	1
Pathologic personalities	480,000	4
Other types of disorders	480,000	4
Total	12,000,000	100

about 1,000,000 or one-twelfth of the Army. This would be in addition to all of those who were rejected at induction and theoretically would reduce the psychiatric problem by only one-half.

Utilization and discharge policy. For each man in the sample, the emotional health on discharge from the service was assessed on the basis of his military medical records, his own statements, the course of his illness since discharge, and his condition on follow-up examination. Seven percent were evaluated as normal on discharge, 8 percent had neurotic symptoms short of an actual neurosis, and 55 percent had neuroses which were not severe. This gives a total of about 70 percent who had less than severe neuroses on discharge. About 10 percent had various organic illnesses and behavior disorders of varying degree of severity. Twenty percent were considered to have severe neuroses. This contrasts sharply with the 55 percent of the entire sample who received medical discharges for psychoneuroses.

TABLE 11. *Possible preservice personality figures for patients admitted for psychoneurosis*

Preservice personality	Frequency distribution	
	Number	Percent
Well-integrated	86,000	14.3
Neurotic traits	206,000	34.3
Suggestive neuroses	99,000	16.5
Overt neuroses	88,000	14.7
Pathologic personalities	121,000	20.2
Total	600,000	100.0

On follow-up, 7 percent of the entire sample were not working, and an additional 6 percent were working only part time, because of illness. The more severe the illness at follow-up, the higher the proportion of those whose ability to work was affected. In comparison with 13 percent for the entire sample, the percentages are 2 for those with a mild neurosis, 26 for those with moderate neurosis, and 79 percent for those with severe neurosis. If these percents are applied against the diagnostic breakdown of men discharged for disability at the time they left the service, it may be estimated that about 60 percent of the men who were discharged as incapable of performing any effective military service were able to work according to civilian standards.

The above evidence confirms the fact which became apparent during the last war that the use of limited capacity personnel has been deficient. For a time, in 1943, by War Department directive, limited service personnel (with but few exceptions) were medically discharged. Men were taken from jobs which they were performing satisfactorily and sent home. At the end of the war medical discharges were again encouraged in many instances because of lack of assignments and, in some instances, because of shortage of hospital beds. It was not unusual to induct men with psychiatric disorders for which others were being discharged. In any group of men inducted, regardless of the rigidity of the standards, a certain percent will be found unsuitable for general service from the start because of emotional disorders. As time goes on, particularly in wartime, there will be a gradual increase in the number of such men in the Army as a result of emotional disorders which develop in connection with the various stresses inherent in military life, the most obvious one being combat.

If the manpower pool were for practical purposes limitless, it would be possible to maintain a policy of using only those capable of general service and discharging the rest, but this is not the case, and limited as well as general service personnel must be used. Because it is conceivable that the exigencies of any given military situation may require limited service personnel to operate beyond their usual capacities (and even in combat), it would seem important to conserve such manpower. Once a man has been discharged from the service as medically disabled, the chance of his ever being used again by the military services is practically nil. Under a liberal discharge policy the natural forces which make men avoid danger drive more and more men in the direction of limited service and discharge.

The use of men with psychoneuroses is just one part of this problem, but the one with which we are here concerned. The results of this study would suggest that at least half of those in the sample who were medically discharged could have been used if proper assignments had been found for them. If about 250,000 men were discharged from the

Army for psychoneurosis during the last mobilization, it can be assumed from the above estimate that at least 125,000 were needlessly discharged as disabled. Apart from the loss of manpower that this entailed, and the effect on the morale of the Army, it is possible that the fact of a medical discharge carries with it certain liabilities to both the man and the country. A man who is discharged on psychiatric grounds appears to be twice as apt to be sicker on follow-up than an identical man who was returned to duty and eventually discharged for the convenience of the government. Also, if a man were returned to duty, the chances are 2.5 times as great that he will not be given any compensation.

In one experimental project of retraining psychoneurotics after breakdown in the last war, many were rehabilitated for assignments in the service branches in the zone of the interior and to a large extent the failures which resulted stemmed from inadequacies in the assignment process (5). It may not be possible to devise a system for using increasing numbers of limited service personnel within the framework of the Armed Forces. A system of universal mobilization in time of emergency might then provide the answer by permitting interchange between military and nonmilitary assignments. Certainly the disability discharge should not be used as an expedient to solve the problem of no assignment.

Once a man has lost time from duty for a psychoneurosis, are there any criteria to indicate his potential for further service, apart from usual clinical judgment, his response to treatment, et cetera? The fact that a man was overtly neurotic prior to induction is in itself important because only 6 percent of this group were able to render any effective service after having once been hospitalized. The possibility that insufficient effort was taken to find appropriate assignments for these men following return to duty is partially refuted by the finding that many men in the normal group who broke down were capable of effective service after breakdown. This would appear to indicate a better adjustment potential but many of these cases were the result of combat, so that a totally different military situation and different motivational forces were involved. Even if the adjustment potential of the neurotic group were generally poor, it is possible that through the use of a more careful assignment procedure many more than 6 percent would be capable of rendering effective service after breakdown. Only one of the 44 men who had overt neuroses prior to service and who claimed to have had at least moderate impairment in their ability to function before entering the service was capable of rendering good and continued service once having been hospitalized. Of 6 such men who, in addition, claimed that their health was poor on entering the service, none ever reached combat. It may be that in the last war such men were "induction errors and apart from them it does not seem possible to predict the subsequent performance of those who broke down.

(5) Menninger, W. C.: Psychiatry in a Troubled World. Macmillan Co., New York, N. Y., 1948 p. 313.

It is possible (and according to many psychiatrists even probable, particularly if the experience with combat cases is remembered) that the mere act of taking such a man off duty status and placing him in a hospital or other treatment facility in itself decreases to a large degree his chance of being effective again in the service. Some of the more severe cases will require hospitalization, but it was a common observation that, because of the absence of any other kind of facility, most of the psychoneurotics who were hospitalized in the service would not have been hospitalized for the same difficulty in civil life. In combat areas, barriers had to be set up to control the very great pressure to get into a hospital. In general no such system operated in the zone of the interior except where outpatient or mental hygiene clinics were established. Unless changes in the assignment and hospitalization systems can be made, it can be postulated that about 50 percent of those who are overtly neurotic before service and who get into the Armed Forces will be hospitalized after about 13 months of service and that, at that point, their military usefulness is for practical purposes over. Although many psychiatrists held such convictions, based on their impressions, this study gives these impressions statistical confirmation.

Relationship between induction and utilization policies. It is axiomatic that if criteria for induction are set up, they must be in relationship to something (6). The assumption is that they are related to the ability to perform military service. Elementary as this may be, experience has shown that this has not always been the case. Even at present, men are probably being inducted with conditions for which others are being discharged. Induction criteria presuppose the use of personnel with limited capacity whereas there is no such official policy. The question, "What are men being inducted for?" must be answered if (1) intelligent induction is to be planned, (2) wastage of manpower is to be avoided, (3) psychologic harm is to be prevented, and (4) unnecessary compensation burdens are to be avoided and confusion eliminated. Our study is not concerned with the problem of a small volunteer, peacetime army, such as existed between World War I and World War II. Recruitment standards were then geared to the number of men who were volunteering. In a period of economic depression, volunteers are plentiful and physical standards are raised, but in times of prosperity, fewer men volunteer and standards must be lowered if authorized strength is to be reached. Our study is concerned with mobilization—partial or complete—in which men are drafted into service. If an enlarged cadre-type of force is wanted—one that is composed entirely of general service men—rigid induction criteria must be established. To accomplish this under the draft would either involve the rejection of many men who could be of use or encourage conscious or unconscious flight into illness in many who feel the need to avoid military service.

(6) The factors of national morale and of productive capacity as they relate to induction policy have not been considered here.

CONCLUSIONS

Induction. By World War II standards, the men in our sample who were overtly neurotic prior to service should have been rejected. Yet they made a significant contribution to the military effort, even in combat. To the extent that induction screening is directed at the procurement of men having the capacity for adequate military performance, a more rigorous psychiatric screening than prevailed in World War II offers no prospect of gain. This is because, in this study, a much more rigorous psychiatric examination than was given at induction still does not permit the discrimination, in advance, of a set of men whose military performance can be called submarginal. No conceivable induction psychiatric screening can eliminate more than about half of the admissions for neurosis, and the cost of so doing would be the rejection of about 10 percent of those accepted in World War II. Only 35 percent of the sample had an overt neurosis or a pathologic personality at induction. Another 17 percent had a suggestive neurosis. In the aggregate these 3 groups probably included about 1 million out of 12 million men in the Army. Criteria for judging adequacy of military performance seem lacking and it is believed that if marginal military performance were defined in terms of the man whose military contribution just exceeds the cost of training him, a large number of men excluded in World War II would be called useful in this limited sense. Other than narrowly military criteria are involved in the selection of manpower for military service and it is not asserted that these men should be taken, but only that, if a military force larger than that of World War II were required, additional men could be taken without reaching the marginal point of no return.

Utilization. However poor personnel utilization was in World War II, it sufficed to permit overt neurotics, admitted through error, to make a useful military contribution. The evidence of the study is, however, that there is ample room for improvement in personnel utilization. Because hospitalization per se aggravates the disability in many psychoneurotics (including the many with conditions which are mistakenly labeled as organic disease), the system of medical treatment in the Army which depends to such a great extent on hospitalization should be radically revised in the direction of outpatient treatment. Inasmuch as in any mobilization there will be a gradual increase in the number of limited service personnel, some policy should be worked out ahead of time for their use, rotation, or discharge by channels other than medical.

Disposition. The disposition policy must be closely articulated with the induction policy. In World War II this articulation was less than satisfactory. Many men were given a certificate of discharge for disability whose emotional health was no worse than that of men being inducted, and by civilian standards relatively few of the men in the sample were unable to work full time because of illness. This study suggests that the

fact of a medical discharge for psychoneurosis may itself impair ability to adjust in civil life. Comparison of two carefully matched groups, one discharged on points, the other for disability, reveals that more of the men in the latter group were ill at follow-up. Men who had a moderate to marked impairment with an overt neurosis at entry apparently were unable to make any effective military contribution after breakdown. The disposition policies of World War II would be impractical in a military situation requiring a much larger mobilization, since discharge for psychoneurosis would effectively bar subsequent military duty almost regardless of the extent of recovery. In a long-lasting conflict such men would be particularly needed.

BOOK REVIEW

Immuno-Catalysis, And Related Fields of Bacteriology and Biochemistry, by *M. C. Sevag,* Ph. D., Associate Professor, Department of Bacteriology, School of Medicine, University of Pennsylvania, Philadelphia, Pa., with a preface by *Stuart Mudd,* M. A., M. D., Professor of Bacteriology, School of Medicine, University of Pennsylvania, Philadelphia, Pa., 2d edition. revised and enlarged. 547 pages. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price $12.

This new edition of an excellent treatise on the interrelationships between the phenomena of immunity and biocatalysis has been enlarged to include a chapter on the physiology and biochemistry of shock. The immunologist and the enzymologist will welcome the manner in which the author has brought up to date the chapters on antibody formation, immune and enzyme reactions, antienzyme immunity, and problems of production of antibodies against respiratory enzymes. The presentation of the controversial aspects of the problem has only in a few instances been biased by the author's own research; particularly is this true in the aspects of immunochemistry and infectious disease. The chapter on shock consists of a survey of the physiologic changes accompanying the various types of shock and is followed by a discussion of histamine, acetylcholine, and tissue proteolytic enzymes that are believed to be the specific factors responsible for the reactions occurring in shock. The book is highly recommended to the specialists in immunity and enzymes and to the biochemist trained in bacteriology and immunology. It is a valuable reference book for the experimental pathologist but is not recommended to the clinician.—*Maj. E. M. Parrott, MSC, U. S. A.*

BOOK REVIEWS

Primary Anatomy, by *H. A. Cates*, M. B., Professor of Anatomy and Director of the School of Physical and Health Education, University of Toronto. 2d edition. 344 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publisher, 1951.

This is the second edition of a textbook on anatomy which was primarily designed for nonmedical students who need a basic knowledge of anatomy. The large standard text of anatomy would be superfluous to the needs of students of nursing, public health, physiotherapy, et cetera. This volume is printed in two columns and contains many illustrations, designed in some instances to show the physiologic function of the structure discussed. The finer points of anatomic relationship are not fully covered but this in no way detracts from the purpose for which the book was written. The author has briefly described the development of the various systems. In many instances the practical application of the anatomic structure is discussed, adding to the interest of the subject. This book could well be used by pre-medical students and the many fine illustrations constitute an excellent visual aid in teaching anatomy to medical corpsmen, first aid students, physiotherapists, and health educators.

—*Lt. Col. M. E. Groover, Jr., U. S. A. F. (MC)*

Poisons, Their Isolation and Identification, by *Frank Bamford*, B. Sc., Late Director of the Medico-Legal Laboratory, Cairo. Revised by *C. P. Stewart*, D. Sc., Ph. D., Reader in Clinical Chemistry, University of Edinburgh; Senior Biochemist, Royal Infirmary, Edinburgh; with a foreword by *Sir Sydney Smith*, C. B. E., F. R. C. P., Regius Professor of Forensic Medicine, University of Edinburgh. 3d edition. 316 pages; 23 illustrations. The Blakiston Co., Philadelphia, Pa., publishers, 1951. Price $5.50.

This volume is essentially a compendium of methods found useful for the identification of toxic agents encountered in a chemical laboratory devoted to medicolegal problems. The coverage of the work is indicated by its chapter headings: Classes of Poisons, Volatile Poisons, Metallic Poisons, Corrosive Acids and Alkalies, Organic Poisons, Alkaloids, et cetera. Each chapter indicates the general symptoms, preliminary micro tests, methods of sampling, and quantitative determination of the toxic agent. The text will be useful to those who wish to have readily available tested methods for the identification of poisons. Its comprehensive coverage is unequalled in any similar volume which has come to my attention. It is recommended as a reference for medical libraries, as well as a laboratory manual for an advance course of study in forensic chemistry.—*Commander H. C. Dudley, MSC, U. S. N.*

Frostbite in Korean Casualties[1]

Luther G. Bell, *Captain, MC, U. S. N.*
LeRoy H. Stahlgren, *Lieutenant, junior grade, MC, U. S. N. R.*
Bernard D. Sherer, *Lieutenant, MC, U. S. N.*

FROSTBITE has been a major medical problem in military campaigns throughout recorded history and has included a variety of poorly understood clinical entities for which many therapeutic measures have been tried. Despite the fact that over 60,000 such cases were reported in World War II, experiences with a large group of frostbite victims indicate a general need for a wider acquaintance with this syndrome. Larrey's (2) account of cold injuries, as observed while serving as Surgeon General to Napoleon's armies during the retreat from Moscow, is the first modern writing on the subject. In the Crimean War cold, muddy trenches were thought to be the cause of painful feet among the soldiers (3). The "trench-foot" syndrome observed during World War I was described by Greene (4) and others. World War II introduced similar types of cold injuries, named after the manner in which they occurred, such as "immersion foot" (5-7), "shelter foot" (8), and high altitude frostbite (9).

In 1900, Rischpler (10) recorded the microscopic changes that occur as animal tissue is frozen and particularly commented on the degenera-

(1) U. S. Naval Hospital, Philadelphia, Pa.

(2) Larrey, D. J.: Memoires de Chirurgie Militaire, et campagnes. C. J. Smith, 1812. Vol. 3, Paris; p. 60.

(3) Medical and Surgical history of the British Army which served in Turkey and the Crimea during the war against Russia in the Years 1854-1856. London, 1858. Vol. 2, p. 187.

(4) Greene, R.: Frostbite and kindred ills. Lancet 2: 689-693, Dec. 6, 1941.

(5) Webster, D. R.; Woolhouse, F. M.; and Johnston, J. L.: Immersion foot. J. Bone & Joint Surg. 24: 785-794, Oct. 1942.

(6) White, J. C., and Scoville, W. B.: Trench foot and immersion foot. New England J. Med. 232: 415-422, Apr. 12, 1945.

(7) White, J. C.: Vascular and neurologic lesions in survivors of shipwreck; Immersion-foot syndrome following exposure to cold. New England J. Med. 228: 213-222, Feb. 18, 1943.

(8) Knight, R.W.: "Trenchfoot" in civilians. Brit. M. J. 2: 610, 1940.

(9) Davis, L.; Scarff, J. E.; Rogers, N.; and Dickinson, M.: High altitude frostbite; preliminary report. Surg., Gynec., & Obst. 77: 561-575, Dec. 1943.

(10) Rischpler: Cited by White and Scoville (6).

tion and vacuolation of cells in blood vessel walls. Investigations of trench foot in World War I by Smith et al. *(11)* was the first actual reproduction of cold injuries in experimental animals under conditions simulating those seen clinically. They produced trench foot in rabbits by exposing them to cold but not necessarily freezing temperatures and observed the tissue response, which they noted was typical of subacute inflammation. The inflammatory response was aggravated by circulatory embarrassment, the presence of moisture, and rapid warming of the part.

Lewis *(12-14)* helped to clarify the changes by properly emphasizing the importance of damage to the most peripheral components of the vascular bed. He pictured the initial vasoconstriction, which was both peripheral and central in origin, as the cause of local ischemia resulting in cellular degeneration and release of a histaminelike substance. These factors produced increased capillary permeability and vasodilatation resulting in a "flooding" of the part with tissue edema. This fairly typical inflammatory response reached its height in about 3 days and then gradually subsided in 2 weeks, depending on the intensity, duration, type of exposure, and individual reaction or susceptibility. During the period when the inflammatory response was acute and the tissue edema pronounced, the pulses were bounding and the part warm, masking the damaging cellular anoxia which persisted. As a result of these processes peripheral clotting occurred which further embarrassed the delivery of oxygenated blood to the most distal vascular bed.

Lempke and Shumacker *(15)* further clarified the basic physiologic and pathologic changes in cold injuries by stressing the primary injurious effect of cold on ischemic tissues and the resultant "obliteration of the arterial tree by thrombosis." They produced frostbite in the tails of mice and then tried several methods of treatment using fairly adequate controls. Because agents producing vasodilatation (such as the tetraethylammonium ion) and inhibiting coagulation (such as heparin) caused a decrease in the loss of tissue, the authors concluded that the pathologic changes which these agents minimize are important in the functional pathology of frostbite.

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(11) Smith, J. L.; Ritchie, J.; and Dawson, J.: Clinical and experimental observations on pathology of trench frostbite. J. Path. & Bact. 20: 159, 1915.

(12) Lewis, T. Observations on some normal and injurious effects of cold upon the skin and underlying tissues; reactions to cold, and injury to normal skin (Holme lecture). Brit. M. J. 2: 795-797, Dec. 6, 1941.

(13) Lewis, T.: Observations on some normal and injurious effects of cold upon skin and underlying tissues; chilblains and allied conditions (Holme lecture). Brit. M. J. 2: 837-839, Dec. 13, 1941.

(14) Lewis, T.: Observations on some normal and injurious effects of cold upon skin and underlying tissues; frost-bite (Holme lecture). Brit. M. J. 2: 869-871, Dec. 20, 1941.

(15) Lempke, R. E., and Shumacker, H. B., Jr.: Studies in experimental frostbite; evaluation of several methods for early treatment. Yale J. Biol. & Med. 21: 321-334, Mar. 1949.

Lange et al. (16) followed the physiologic changes in frostbitten rabbit legs by means of intravenous fluorescein which appeared in the extremities at the time of the vascular engorgement but did not appear when the test was repeated from 2 to 12 days later after capillary thrombosis had occurred. By demonstrating the effectiveness of heparin in human volunteers they believed that they had incriminated capillary clotting as an important factor in the process of frostbite. The available experimental data indicate the importance of initial cellular damage due to cold and local ischemia caused by thrombosis in the most peripheral vessels in patients with cold injury.

DESCRIPTION OF CASES

The 150 patients here reported were taken from a group of 175 casualties removed from the Korean theater during and immediately following the dramatic retreat from the reservoirs. On transfer to this hospital they were admitted to one of three wards, depending on the severity of their lesions. During the course of treatment each was classified according to the degree of frostbite sustained. First degree implied loss of superficial dermal layers (peeling); second degree, loss of the full thickness of the skin and superficial subcutaneous tissue; third degree, loss of deep subcutaneous tissue and distal parts; and fourth degree, major tissue loss including bone. These victims, whose average age was 21 years, were for the most part dressed comfortably for cold weather. Footgear consisted of waterproof rubber boots with removable inner soles. Over 75 percent wore two pairs of woolen socks and most of the remainder wore two woolen pairs and one cotton pair. The enemy attacked with overwhelming force toward the end of November 1950 under extreme climatic conditions. Temperatures ranged between -20° and -30° F. and were lower in certain sectors. The retreating marines were forced to fight their way toward the coast under these adverse conditions with few fires, no warming tents, and no warm food. With an understanding of this basis of physical exhaustion, the precipitating causes of frostbite in these patients will be described.

CAUSATIVE FACTORS

Constantly wet skin bears an increased susceptibility to cold because of its greater conductivity. Over 60 percent of the victims were frostbitten while pinned down by enemy fire after a long march. They were forced into cramped positions in foxholes where they remained inactive with their feet lying in snow and their socks wet from perspiration. Proper foot care (change into dry socks, massage, warming with body heat) before the wet footwear froze would have prevented or lessened the severity of the frostbite, but there was rarely time for such measures. The average length of time between changes of socks was 4½ days and in many cases over 10 days. Of the remaining 40 percent, 10 percent had been wading in icy water before being frostbitten. The

(16) Lange, K.; Weiner, D.; and Boyd, L. J.: Frostbite; physiology, pathology and therapy. New England J. Med. 237: 383-389, Sept. 11, 1947.

shoes, socks, or mittens of 3 percent were burned, stolen by the enemy, or lost.

Thirty-seven (25 percent) of the group suffered wounds and these patients were generally the most severely frostbitten. Various factors were at work but undoubtedly the most significant was the vasomotor imbalance occurring in the wounded part. In every patient if a limb was wounded the extremity was also frostbitten. One patient was struck in the right shoulder by shell fragments which injured the right thoracoacromial artery. His right hand was severely frostbitten with resultant gangrene and loss of all fingers and the distal one-half of the thumb. His left hand suffered only first degree frostbite.

These findings were seen in other wounded extremities in which there was no injury to vessels supplying the part. It is probable that the reflex vasoconstriction from the wounds contributed to the intensity of the local ischemia thereby increasing the severity of the permanent tissue changes. Other factors such as constricting bandages and immobilization of the part by splinting aggravated the circulatory stasis, therefore the ischemia.

The importance of vasomotor instability was also suggested by the fact that 41 percent of the patients had experienced previous leg or foot trouble. Of these, 21 percent had complained of painful leg cramps, 9 percent had suffered previous trauma such as fractures, wounds, or operative procedures on the injured extremity and 3 percent had noticeable varicosities. One patient suffered wounds of his right leg 2 months earlier. When exposed to freezing temperatures during the retreat, his right foot was more severely frostbitten and the site of more pronounced residual symptoms than his left foot. Two patients complained of symptomatic pes planus, hyperhidrosis, painful ingrown toenails, and previous frostbite.

Numerous other causative factors important in the development of cold injuries, such as trauma to the frostbitten extremity, cigarette smoking, and race, have been mentioned by other authors. The trauma of marching affected the severity of tissue damage in some patients. The distance walked after frostbite varied from 0 to 70 miles (average 13). We believed that there was some correlation between this added trauma and the extent of injury. Smoking apparently did not play a significant role in this group. Thirteen percent of the victims did not smoke in the combat zone. This figure compares favorably with the general average for frontline troops. The ratio of white to Negro casualties approximated the divisional proportion so that there was no evidence of particular racial susceptibility.

INITIAL SYMPTOMS

Most of the victims did not suspect the severity of frostbite from their early symptoms. Many (17 percent) were not aware that they had been frostbitten until told after routine foot inspection. The initial

warning signs and symptoms are shown in table 1. Nearly 50 percent experienced no specific symptomatic evidence that they had been frostbitten. This indicates the need for close inspection of the feet and hands at frequent intervals to detect painless blisters, swelling, or discoloration. By this method, the added trauma of marching and further exposure to cold may possibly be avoided.

TABLE 1. *Warning signs and symptoms in 150 patients with cold injury*

Sign or symptom	Percent
Pain	25
Numbness	25
Painless blisters	17
Discoloration	16
Swelling	6
Paresthesias	5
Stiffness	3
Miscellaneous	3

LATE SYMPTOMS

Only 5 percent of patients were symptom-free when seen from 45 to 75 days following their evacuation. The reliability of some of the complaints was difficult to evaluate because of variability of the pain threshold, but after comparing physical changes with complaints, we believe that most patients were reliably reporting their residual symptoms (table 2).

Most of these symptoms appeared on sudden change of temperature such as occurs when walking from a warm room to the outside or vice versa. Paresthesias included burning, tingling and numbness. The symptoms were found to be most marked in the presence of objective findings such as excessive perspiration, swelling, and dependent discoloration.

TABLE 2. *Residual symptoms in 150 patients with cold injury*

Symptoms	Percent
Hyperhidrosis	67
Paresthesias when cold	57
Paresthesias and weakness of part when walking	39
Dependent pain or discoloration	30
Pain when cold	30
Paresthesias when warm	11
Pain when warm	8
Swelling	7
Stiffness	4

DEGREE AND LOCATION OF INJURY

All injuries were at least second degree. The parts injured are shown in table 3. In one patient one elbow, one knee, one ear, and the penis suffered frostbite. Increased severity in one limb was not seen except in patients with a wound or previous trauma to the frostbitten part.

TABLE 3. *Parts injured in 150 patients with cold injury*

Part	Percent
Fingers and toes	63
Limited to feet	27
Limited to toes	8
Limited to fingers	2
Nose	3

INITIAL TREATMENT

Five percent reported that they had been treated immediately. The time elapsing between recognition of frostbite and treatment in the remainder ranged from a few hours to 21 days (average 5½ days). Each patient was questioned carefully about the treatment given including medication, advice, and operative procedures. Those who were uncertain about important aspects of their care were omitted from this report. Even though such an approach must result in some inaccuracies, the results may at least serve as a general indication of the treatment given. (table 4). Most of the bed patients were ambulatory at intervals for toilet, meals, et cetera. Fourteen percent stated that their feet were

TABLE 4. *Treatment given to 150 patients with cold injury*

Treatment	Percent
Bed rest	72
Instructions	
No smoking	68
No coffee	30
Antibiotics	
Penicillin	34
Aureomycin	2
Heat	25
Dicumarol	3
Vitamins	2
Vasodilators	
Blocks	1
Procaine, given intravenously	3
Whiskey	10
No treatment	6

elevated while reclining. Most of the wounded received morphine and other opiates as would be expected. The relations of these drugs to frostbite has not been determined.

LATE TREATMENT

All patients with (1) infected wounds; (2) incompletely separated gangrenous parts; (3) incompletely epithelized denuded, areas; and (4) excessively painful areas were not allowed to bear weight on the injured part. Complete bed rest for some of these otherwise healthy young men, many of whom were discouraged by the long convalescence, was difficult to enforce, but we believed that noticeable benefit was derived from thus decreasing the trauma to the affected part. Laxity in following the order was frequently followed by a flare-up of secondary infection at the level of demarcation of healthy tissue. In the presence of open or demarcating lesions, the injured parts were kept elevated.

Conservative and careful débridement of dead tissue was practiced daily to insure adequate drainage. In patients with weeping, gangrenous, and painful wounds electric fans were directed toward the area to increase comfort and to decrease maceration of questionably viable tissue. Intermittent soaks in tepid water or saline solution (sterile if wounds were open) were prescribed to cleanse open wounds and to hasten the process of demarcation of viable and nonviable tissue. The latter was also accomplished by wrapping with wet dressings and then covering the whole with cellophane or oilcloth. No strong antiseptics were applied.

Antibiotics were used only in the presence of secondary infection as evidenced by fever, toxemia, and local signs of inflammation. Penicillin was the agent of choice, but if progress was not satisfactory in 2 days, aureomycin was added. There were no serious complications from infection. Symptomatic relief was not a great problem, but in a few patients with persistent painful paresthesias and excessive perspiration the first 3 lumbar ganglia were blocked with fair results. No sympathectomies were performed. We believed that intermittent soaks with elevation of the part produced the most effective relief. Opiates were almost never given because of the chronic nature of the complaints.

About 5 percent of the wounds were suitable for grafting. Those few lesions with healthy, clean granulations were covered with split thickness grafts to speed healing. These have not been followed long enough to evaluate the results properly.

Physical therapy in the form of whirlpool baths, joint motion, and correction of contractures and muscle weaknesses was helpful. Occupational therapy was of inestimable value in keeping the minds and fingers of many of these restless patients busy.

RESULTS

The interval since discharge has been too short to allow evaluation of the results of treatment except by recording the loss of tissue. Of the 150 patients, a significant amount of tissue was lost in 18 (12 percent). These include 3 bilateral below-knee amputations and 1 bilateral Syme amputation. The remaining 14 patients lost phalanges or whole digits. Smaller amounts of tissue loss such as tips of fingers, toes, and areas on heels and sides of feet were not included because these healed without noticeable deformity.

CONCLUSIONS

Important factors in the high incidence and severity of frostbite among our forces during a 12-day retreat were: (1) impending physical exhaustion; (2) skin constantly wet because of excessive perspiration within waterproof boots and inadequate foot care; (3) local ischemia resulting from vasoconstriction and circulatory stasis; and (4) delay in recognition and treatment. Nearly 50 percent of the 150 patients studied experienced no symptomatic evidence of frostbite. These were detected by inspection which revealed discoloration, painless blisters, or swelling of the part. Residual symptoms were not incapacitating but were present in 95 percent of the series. Hyperhidrosis and paresthesias in response to temperature changes were the most common of these. Initial treatment was begun an average of 5½ days after frostbite was incurred. Because of the conditions under which the injuries occurred, early treatment was inadequate. Late treatment consisted of complete bed rest with elevation of the injured part, conservative daily débridement, and intermittent saline soaks. Wet dressings, antibiotics, paravertebral blocks, and grafting were used. No attempt at early operative treatment was made. Eighteen patients (12 percent) suffered significant loss of tissue. Four of these required major amputations.

An Epidemic of Rheumatic Fever in Japan and South Korea[1]

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DURING mobilization and under conditions leading to crowding, exposure, and fatigue, hemolytic streptococcal infections may present problems of grave import in military medicine. The acute streptococcal respiratory infections have been important not only because of the high noneffective rate noted in epidemics, but also because of the crippling effects of such late nonsuppurative complications as rheumatic fever and acute glomerulonephritis (2-9).

In 1946 several outbreaks of beta hemolytic streptococcal respiratory infections were observed at training centers throughout the United States. Type 17 streptococci were identified as the responsible patho-

(1) Read at Maryland, District of Columbia Regional Meeting of the American College of Physicians, Washington, D. C., 17 February 1951.

(2) Paul, J. R., et al.: The Epidemiology of Rheumatic Fever and Some of Its Public Health Aspects. 2d edition. Printed for the American Heart Association by the Metropolitan Life Insurance Co., 1943.

(3) Hedley, O. F.: Rheumatic heart disease in Philadelphia hospitals; study of 4,653 cases of rheumatic heart disease, rheumatic fever, Sydenham's chorea, and subacute bacterial endocarditis involving 5,921 admissions to Philadelphia hospitals from January 1, 1930 to December 31, 1934; age, race, and sex distribution and interrelation of rheumatic fever, Sydenham's chorea, rheumatic heart disease, and subacute bacterial endocarditis. Pub. Health Rep. 55: 1647-1691, Sept. 13, 1940.

(4) Griffith, G. C.: Rheumatic fever; its recognition and treatment. J. A. M. A. 133: 974-981, Apr. 5, 1947.

(5) Paul, J. R.: Epidemiology of rheumatic fever. Am. J. Med. 2: 65-75, Jan. 1947.

(6) Swift, H. F.: Relationship of streptococcal infections to rheumatic fever. Am. J. Med. 2: 168-189, Feb. 1947.

(7) Swift, H. F.: Etiology of rheumatic fever. Ann. Int. Med. 31: 715-738, Nov. 1949.

(8) Kerr, W. J.: Pathogenesis of rheumatic fever. Ann. Int. Med. 29: 587-594, Oct. 1948.

(9) Rantz, L. A.; Boisvert, P. J.; and Spink, W. W.: Etiology and pathogenesis of rheumatic fever. Arch. Int. Med. 76: 131-138, Sept. 1945.

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gens in three centers, whereas in others, type 19 seemed to be implicated. In World War II, infections due to sulfonamide-resistant strains of group A streptococci were prevalent. One example may be cited in which 89 percent of the type 17 cultures isolated were resistant to blood levels of 5 mg. of sulfadiazine per 100 cc. *(10)*. Most instances of such resistance were probably related to large-scale experiments in the control of respiratory infections with sulfonamides such as those conducted by the Air Force and Navy *(7, 10)*. Carriers of resistant strains may have introduced organisms into susceptible populations not previously exposed to sulfonamide prophylaxis. One such circumstance was encountered at Keesler Air Force Base, Biloxi, Miss., where an outbreak of streptococcal infection occurred. This infection was believed to have been introduced by an inductee from California. Although the isolated organism (type 17 streptococcus) was sulfonamide-resistant but penicillin-sensitive, neither the carrier nor the affected troops had received sulfonamides *(11)*.

The low troop strength of the Army of Occupation in Japan and Korea in the fall of 1946 created a military necessity of some gravity which required that personnel be rushed to these areas. Available replacements consisted largely of young unseasoned recruits and during the period from December 1946 to February 1947 nearly 60,000 of these men were sent by troopship from Seattle and San Francisco to Japan and Korea. Although the directness of the great circle route was logistically desirable, its use was attended by cold, bad weather and rough seas. As a result, the troops remained in crowded compartments most of the time during the 11- to 14-day trip. Streptococcal tonsillitis, pharyngitis, and scarlet fever became prevalent on the troop transports and throat cultures taken at Inchon, Korea, on 15 January 1947 indicated that about 50 percent of the troops debarking from one transport were carriers of beta hemolytic streptococci. About 15 percent of the troops were ill on arrival and required hospitalization. At the same time, replacements were arriving in large numbers at Guam, the Philippines, the Ryukyus and Bonin Islands. These islands all have tropical or subtropical climates. Troopships to these sites followed the Southern route where the weather was warm, permitting troops to spend much time on deck. No outbreak of streptococcal infections or rheumatic fever occurred in these commands.

The critically strained housing facilities in both Japan and Korea rapidly became overcrowded, particularly at the replacement depots. As a consequence, many soldiers who were streptococcal carriers were released to the various divisional and nondivisional units throughout Japan and Korea. Although working quarantine was attempted,

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(10) Coburn, A. F., and Young, D. C.: Epidemiology of Hemolytic Streptococcus During World War II in the U. S. Navy. Williams & Williams, Baltimore, Md., 1949.
(11) Mitchell, R. B., and van Ravenswaay, A. C.: Infectious diseases; hemolytic streptococcic diseases and acute rheumatic fever in AAF. Air Surgeon's Bull. 2: 311-314, Sept. 1945.

it was the experience of one of us in Korea that this expedient, while of value, did not prevent an alarming increase in the upper respiratory infection rate. The rate of clinical infection with hemolytic streptococci in Japan and Korea was not accurately known, but an estimated occur-

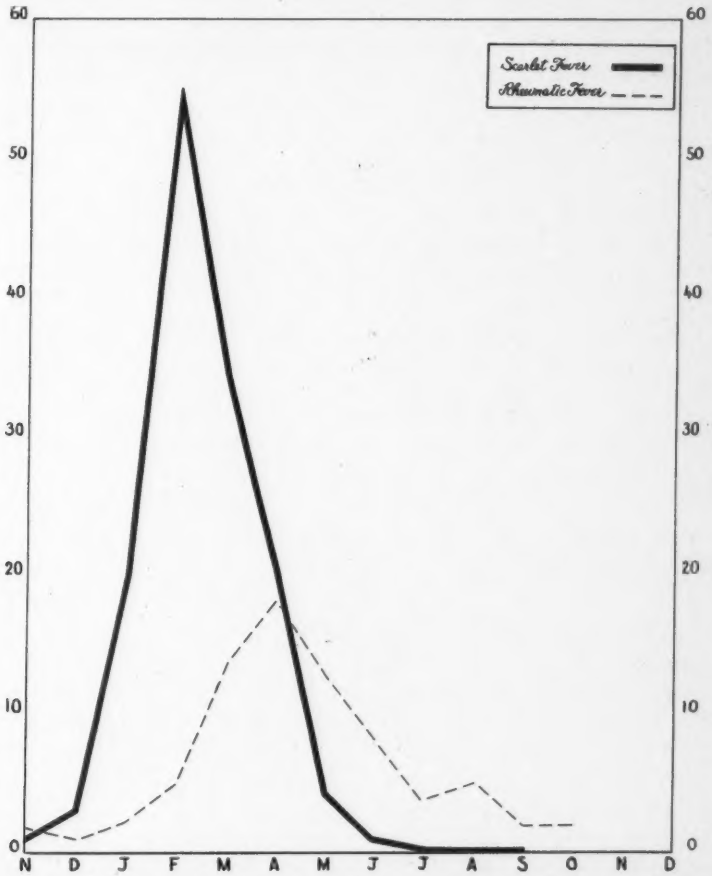

Figure 1. Incidence of scarlet fever and rheumatic fever (per thousand per annum) in Japan and Korea, November 1946 to October 1947.

rence of about 38,000 cases among a troop population of roughly 209,000 constituted an epidemic of significant proportions. Hemolytic streptococcal infections accompanied by punctate erythematous eruptions were readily recognizable and reportable as scarlet fever. A total of 2,237 patients with this entity were reported during the period from December 1946 to June 1947 with a sharp peak incidence of 54 per thousand per

annum in February (fig. 1). It was believed that even these figures were conservative. Strict adherence to quarantine regulations relative to scarlet fever would have resulted in entire hospitals being filled for many weeks. It would have been inconsistent to isolate one form of streptococcal disease, and not others, simply because of a difference in nomenclature. Since it was not feasible to isolate all such patients for prolonged periods, scarlet fever was reported in many instances as streptococcal pharyngitis with secondary toxic erythema and not as scarlet fever.

The prophylactic and therapeutic ineffectiveness of sulfadiazine observed early aboard the troopships was soon appreciated in Japan and Southern Korea. Although penicillin was effective in controlling the acute manifestations and in hastening recovery, its use was limited by availability. Later, as supplies became more plentiful, the use of this drug in single daily doses of 300,000 units parenterally was found to be effective in preventing additional cases in some organizations *(12)*.

Beta hemolytic streptococci were cultured from hundreds of patients, but unfortunately no actual typing was done nor were sulfonamide or penicillin sensitivity studies performed. On the other hand it was clinically demonstrable that the beta hemolytic streptococci responsible for the outbreak were probably resistant to sulfadiazine. The responsible organism, in most cases, was either a type 17 or type 19 Lancefield group A relatively sulfonamide-resistant streptococcus.

The clinical manifestations of the streptococcal respiratory infections were of variable severity and characterized in the typical case by a sudden onset. The symptoms commonly encountered included chilly sensations, fever, generalized aching, and sore throat accompanied by slightly painful deglutition. Redness and edema of the pharynx with associated patchy or diffuse exudates were frequent findings. Regional lymphadenitis of variable tenderness and severity was almost constantly observed in the moderate or more severe cases. Leukocytosis of moderate degree was usually demonstrable and throat cultures, when these were taken, showed a predominance of beta hemolytic streptococci.

The suppurative complications encountered usually responded readily to penicillin. Nonsuppurative sequelas, on the other hand, constituted a more serious problem. During recovery and following an asymptomatic period of about 2 weeks, some patients developed these nonsuppurative complications (fig. 2). Although streptococcal fever occurred in a large number of patients, and acute glomerulonephritis in a few, acute rheumatic fever appeared in epidemic proportions. The relation of the preceding streptococcal infection to this outbreak is shown in figure 1.

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(12) Annual Report, 34th General Hospital, Korea, 1947.

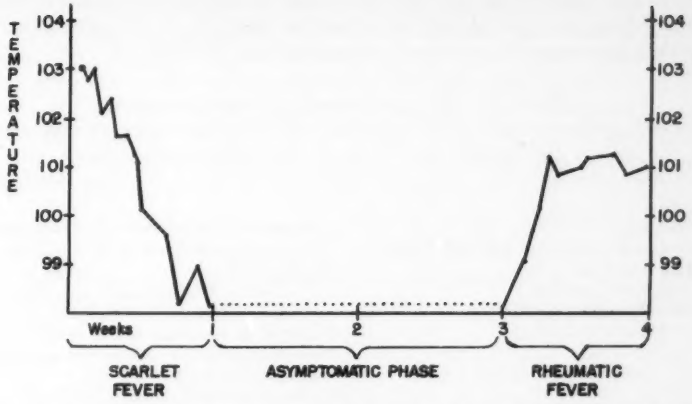

Figure 2. Sequence of events in a typical patient with a streptococcal infection followed by a nonsuppurative complication.

Although the fact that scarlet fever is a reportable disease made it useful as an indicator of this relationship, it was readily apparent that other forms of streptococcal disease were equally important. Even mild, clinically inapparent infections have evidently been rheumatogenic (*13-16*) and it seemed likely that the second smaller increase in the incidence of rheumatic fever shown in figure 1 was caused by infections of this type.

Criteria used for the diagnosis of rheumatic fever were those of Jones (*17*) and are shown in table 1.

A total of 1,146 cases of rheumatic fever was recognized in U. S. Army troops in this outbreak in Japan and South Korea from December 1946 to May 1947. Most of these were evacuated to the zone of the interior as soon as they were transportable. Of this group, 275 patients were studied at the Oliver General Hospital; 15 percent of these gave a history of having developed scarlet fever shortly before the onset of the rheumatic fever; 88 percent stated they had noted a respiratory

(*13*) Rantz, L. A.; Spink, W. W.; and Boisvert, P. J.: Hemolytic streptococcus sore throat; detailed study of simultaneous infection of large number of men by single type. Arch. Int. Med. 76: 278-283, Nov.-Dec. 1945.

(*14*) Commission on Acute Respiratory Diseases: Study of food-borne epidemic of tonsillitis and pharyngitis due to B-hemolytic streptococcus, type 5. Bull. Johns Hopkins Hosp. 77: 143-210, Sept. 1945.

(*15*) Rantz, L. A.: Natural history of hemolytic streptococcus sore throat. California. Med. 65: 265-270, Dec. 1946.

(*16*) Kuttner, A. G., and Krumwiede, E.: Observations on effect of streptococcal upper respiratory infections on rheumatic children; 3-year study. J. Clin. Investigation 20: 273-287, May 1941.

(*17*) Jones, T. D.: Diagnosis of rheumatic fever. J. A. M. A. 126: 481-484, Oct. 21, 1944.

infection a few weeks preceding the appearance of the acute rheumatic fever; and only 10 percent gave a history of previous rheumatic fever. Thirty-three percent of the 275 patients studied showed evidence of carditis at some time or other during their illness.

TABLE 1. *Criteria for diagnosis of rheumatic fever*

Major manifestations	Minor manifestations
Carditis Arthralgia. Authenicated history of previous attacks of rheumatic fever. Subcutaneous nodules. Chorea (Sydenham type)	Fever Erythema marginatum (almost a major manifestation) or erythema multiforme. Abdominal pain. Precordial pains, especially in a young person. Repeated nontraumatic nosebleed. Pneumonitis with or without pleurisy Laboratory evidence: 1. Increased sedimentation rate. 2. Rising antistreptolysin titer. 3. Leukocytosis which persists indefinitely. 4. Microcytic anemia.

Confirming the observations of Griffith *(4)*, we found the most helpful criteria in the diagnosis of rheumatic fever in young soldiers to be acute arthritis, evidence of carditis, fever, persistent elevation of sedimentation rate, and arthralgias. In young adults chorea, subcutaneous nodules, or epistaxis are rather rare manifestations of acute rheumatic fever.

Atypical manifestations *(18)* in young soldiers were not infrequent. These were: (1) absence of acute arthritis or arthralgia, (2) monarticular involvement, (3) absence of fever during the acute stage, (4) involvement of the small joints of the hands or feet, (5) onset with pleuritis, and (6) onset with pneumonitis.

Significant mitral systolic murmurs were not infrequent among the group who had manifestations of carditis. These characteristic mitral systolic murmurs often diminished as the carditis improved. Other patients showed either little change or, at times, definite increase in the intensity of the murmurs. Many of the patients with carditis developed aortic diastolic murmurs while under observation. In some, the aortic diastolic murmur diminished as the patient showed clinical improvement.

The differentiation of many of these cases from rheumatoid arthritis often proved to be difficult and time consuming. Cases of subacute rheumatoid arthritis were not infrequently tentatively diagnosed acute

(18) Sokolow, M., and Snell, A. M.: Atypical features of rheumatic fever in young adults. J. A. M. A. 133: 981-989, Apr. 5, 1947.

rheumatic fever. Careful clinical observation over a period of many weeks was often required to differentiate the two.

In addition to rheumatoid arthritis, the other conditions that were frequently considered in the differential diagnosis were: (1) gonorrheal arthritis, (2) palindromic rheumatism, (3) infectious arthritis, (4) drug reactions, notably of the serum sickness type that sometimes follows penicillin therapy (especially penicillin in beeswax and peanut oil), (5) subacute bacterial endocarditis, and (6) lupus erythematosus disseminatus.

Figure 3 shows the incidence of scarlet fever and rheumatic fever among Army and Air Force troops in Japan and South Korea from 1946 to 1949 inclusive. The rates for the year preceding and the 2 years following the 1947 epidemic are definitely lower than was the incidence of rheumatic fever and scarlet fever in troops within the continental limits of the United States during the same period (19).

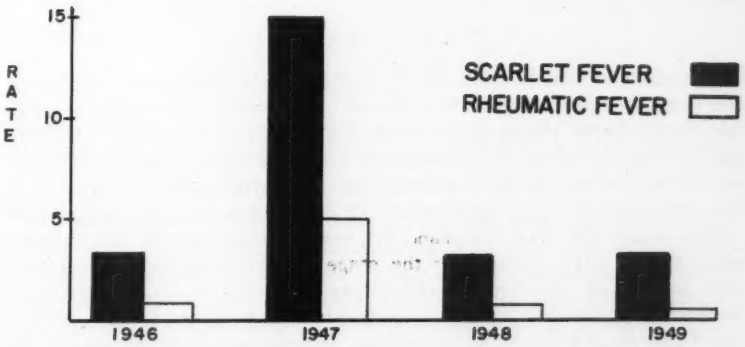

Figure 3. Rates per thousand per annum for scarlet fever and rheumatic fever in Japan and Korea during the years 1946-1949, inclusive.

Recrudescences of rheumatic fever tend to occur in about 50 percent of patients who develop subsequent hemolytic streptococcal infections. Massell (20) has shown that prompt intensive penicillin therapy for hemolytic streptococcal infections in such patients prevents recurrences. He stated that penicillin coverage must be maintained at effective levels for about 10 days if such recrudescences are to be prevented. The Armed Forces Epidemiology Board (21, 22) has recently shown that the prevention of primary rheumatic fever episodes is now fea-

(19) No significant outbreak of streptococcal respiratory infection or rheumatic fever has appeared in United Nations troops in the Korean War.

(20) Massell, B. F.: Salicylates, hormones and penicillin in treatment of rheumatic fever. Med. Clin. N. America 34: 1419-1434, Sept. 1950.

(21) Denny, F. W.; Wannamaker, L. W.; Brink, W. R.; Rammelkamp, C. H. Jr.; and Custer, E. A.: Prevention of rheumatic fever; treatment of preceding streptococcic infection. J. A. M. A. 143: 151-153, 13 May 1950.

sible. In order for this to be accomplished it is essential that streptococcal infections be correctly diagnosed at the onset.

Typical cases of streptococcal respiratory infections follow the pattern described earlier. There is usually a sudden onset with chilliness, a sore throat with pain on swallowing, diffuse redness and edema of the pharynx, patchy or diffuse exudate, tenderness of the cervical lymph nodes, an elevated leukocyte count, and a predominant growth of group A streptococci on throat cultures. Milder, as well as more severe cases, often occur.

If the initial attack of rheumatic fever is to be prevented, penicillin therapy must be begun immediately during the early phase of the streptococcal respiratory infection without waiting for the results from the throat culture. If, after 48 hours, the throat culture proves to be negative, penicillin can be discontinued; otherwise, penicillin coverage should be maintained for at least 7 or 8 days *(21, 22)* To date no strain of group A streptococcus has shown significant resistance to penicillin *(23)*.

CONCLUSION

A serious epidemic of group A streptococcal respiratory infections due to apparently sulfonamide-resistant streptococci developed in Japan and South Korea among U. S. Army and Air Force troops in January and February of 1947. The origin of the streptococci was probably in the United States. It appears likely that Lancefield group A, type 17 or 19, streptococci were responsible. The shipment of raw, unseasoned troops to the Far East Command in crowded troopships by the northern route during cold weather set the stage for the outbreak. Sulfadiazine was ineffective. A shortage of housing for troops in South Korea and in bombed areas in Japan impaired quarantine measures. A serious epidemic of streptococcal respiratory infections developed among the troops and was followed by a sharp and definite outbreak of rheumatic fever. Scarlet fever was useful as an indicator of the relationship between streptococcal infection and rheumatic fever. Two thousand, two hundred thirty-seven cases of scarlet fever were reported. One thousand, one hundred forty-six cases of rheumatic fever occurred. Although only 15 percent of 275 rheumatic fever patients who were closely studied gave a history of scarlet fever, 88 percent of this group did give a history of sore throat immediately preceding the appearance of the rheumatic fever. Thirty-three percent of these 275 patients showed evidence of carditis. In the young soldier, rheumatic fever is manifested by polyarthritis more frequently than in children, but carditis occurs with less frequency. Rheumatic fever in the military

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(22) Wannamaker, L. W.; Rammelkamp, C. H., Jr.; Denny, F. W.; Brink, W. R.; Houser, H. B.; Hahn, E. O.; and Dingle, J. H.: Prophylaxis of acute rheumatic fever by treatment of preceding streptococcal infection with various amounts of depot penicillin. Am. J. Med. 10: 673-695, June 1951.

(23) Romansky, M. J.: Personal communication.

age group often begins with atypical clinical features and runs an atypical course. Monarticular involvement, absence of acute arthritis, or arthralgia, absence of fever during the acute stage, involvement of the small joints of the hands and feet or of a single large joint, and onset with pleuritis and/or pneumonitis are some of the outstanding atypical manifestations. After a streptococcal infection, even the mildest joint pain becomes significant and should lead to careful evaluation for the presence of or absence of rheumatic fever. Although the prevention of sporadic cases of streptococcal respiratory infections appears not to be feasible, epidemics of streptococcal respiratory infections are probably controllable. From the work of the Army Epidemiology Board it appears that rheumatic fever can be prevented by the prompt and correct diagnosis of streptococcal respiratory infection and by immediate and adequate treatment with penicillin.

BOOK REVIEW

Congenital Dislocation of the Hip, by *Julius Hass,* M. D., New York, N. Y. 405 pages, illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price $12.50.

This monograph combines in one volume the past and present-day thinking regarding the pathology, etiology, diagnosis and management of congenital dislocation of the hip. The author's long association with Lorenz and his own experience in a series of more than 2,000 patients make him pre-eminently fitted to analyze controversial teachings concerning this frequently disabling condition. A clear distinction is made between the pathology and cause in patients with typical congenital dislocation of the hip as contrasted to those having teratologic conditions, as well as those with obstetrical trauma, congenital syphilis, and Little's disease. A classification is proposed which, if generally adopted, would undoubtedly eliminate some of the present confusion pertaining to this subject.

The arguments regarding closed versus open reduction are thoroughly discussed and the author's preference for the middle ground is clearly and convincingly presented. The necessity for early diagnosis and treatment is stressed and the type of management most appropriate for each age group is outlined. This text is fully illustrated with diagrams and photographs and has an extensive bibliography. It should do much to clarify the subject of congenital dislocation of the hip.

—*Col. V. H. Jeffress, MC, U. S. A.*

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The Royal Army Medical Corps Tradesman

Thomas P. Buist, *Lieutenant Colonel, R. A. M. C.*

THE purpose of this article is to present a general picture of the trades of the enlisted soldiers of the Royal Army Medical Corps (R. A. M. C.) including brief accounts of the technical training involved and some indication of the relevant career prospects. A short note is included also on the new sister corps, the Queen Alexandra's Royal Army Nursing Corps (Q. A. R. A. N. C.) whose enlisted women undertake many of these trades as well.

R. A. M. C. enlisted soldiers of the active Army are either National Servicemen or regular soldiers. The former perform 2 years' compulsory service with the colors followed by 3½ years part-time service with the Territorial Army or with the Supplementary Reserve and are normally between 18 and 22 years of age when they join. The latter are men who have enlisted voluntarily for longer periods and have usually joined the R. A. M. C. with a view to a career in one of the trades of the corps. Their ages range form 17½ years upward.

The term "tradesman" is used in the R. A. M. C. in conformity with the other technical corps of the army to indicate a technician or expert trained and qualified in one of the recognized trades or specialties of these corps. In the Q. A. R. A. N. C. the corresponding term is "tradeswoman." The R. A. M. C. is a corps of tradesmen. There is no establishment for nontradesmen and in principle every soldier in the Corps who is not a tradesman is under training to obtain tradesman status.

The 18 trades of the R. A. M. C. and Q. A. R. A. N. C. include:

1. *Ten primary trades*: Nursing orderly, mental nursing orderly, special treatment orderly (venereal disease attendant), laboratory technician, physiotherapist (formerly masseur), radiographer, clerk, clerk orderly clinical (clinical secretary), technical storeman, hygiene assistant*.

*Enlisted women of Q. A. R. A. N. C. *not* eligible.

2. *Four secondary trades*: Operating theater technician, transfusion orderly* (specializations subsequent to qualification as a nursing orderly, the second having trade status in war only), trained nurse (a progression after full training as a nursing orderly), dispenser* (normally acquired as a second trade following qualification in one of the other trades).

3. *Four civil trades*, for which training is not provided in the Army and for which a civilian qualification is necessary: chiropodist, optician*, pharmacist*, surgical instrument mechanic*.

Two additional trades (dental operating room assistant and dental hygienist) are available to the Q. A. R. A. N. C. only.

Dental and veterinary trades are otherwise the responsibility of the Royal Army Dental Corps and the Royal Army Veterinary Corps (R. A. V. C.) respectively. The R. A. V. C. is *not* included in the Army Medical Services.

There are normally 3 classes in each R. A. M. C. trade, class III being the junior. In general it takes at least a year to progress from class III to class II and another year to progress from class II to class I.

In selecting National Servicemen for trades involving much scientific theory, such as radiographer, the choice must be limited to young men of high talent and good education owing to the short period of service. The standard we aim at in selecting a candidate for such trades is that of a young man eligible to enter a university as a science student.

In the case of the regular soldier there is not quite the same urgency and a slightly different program is followed. In general every regular recruit is required to train and qualify as a class III nursing orderly before being trained in another trade. This phase affords the candidate the opportunity of attending classes to improve the general state of his education if necessary. The standard of raw talents required is the same in both cases.

THE RECRUIT STAGE

The *selection* of a soldier for training in a specified trade depends on his assessable talents and the current requirement in the trade concerned. The selection procedure includes a talent assessment by a battery of tests followed by an interview and the preparation of a profile of the man's personality and qualities.

Recruit training. The first 3 months of the R. A. M. C. soldier's service are devoted to recruit training at the Depot and Training Establishment at Crookham. This includes basic military training, drill, fieldcraft, and stretcher work, together with the preliminary phase of his technical training, comprising elementary anatomy, physiology and hygiene and the basic principles of nursing and ward procedure. The preliminary

training is the same for regulars and National Servicemen and is common to all trades. The technical part of it is closely comparable to the curriculum of the initial training of a student nurse in a civil training school and is recognized by the civil authorities as equivalent to it. No R. A. M. C. soldier may commence trade training proper until he has qualified in the passing-out examination at the end of recruit training.

The start of trade training proper. On passing out from the Depot the young regular is normally sent to train for nursing orderly, class III, before proceeding to train in another trade. The young National Serviceman on the other hand is assigned to an appropriate unit to train for class III in his trade and takes the nursing orderly, class III, training at a later stage.

THE NURSING TRADES

Nursing orderly. The training of the regular soldier for the qualification of nursing orderly, class III, is restricted to certain military hospitals in which there is a special teaching department with a sister tutor staff. National Servicemen on the other hand may receive this training in any military hospital. The curriculum and the qualifying examinations are the same for regulars and National Servicemen and they are trained together when in the same unit. The 4-month course comprises further instruction in anatomy and physiology, hygiene, and nursing at a more advanced level than in the recruit training. On completion of the course the regulars booked for trades other than nursing proceed to training in their own trades.

Training for nursing orderly, class II, involves a year's duty as a nursing orderly, class III, of which at least 6 months must be devoted to actual nursing in hospital wards. In addition the candidate attends a course on surgery and surgical nursing. Training for class I comprises a further 12 months of practical nursing in military hospital wards and the third year lectures, on general medicine, tropical diseases and medical and infectious nursing, materia medica, and dietetics. A nursing orderly, class I, thus has had at least 18 months' practical nursing experience in military hospital wards. Normally it takes 3 years to obtain the class I qualification.

Fourth year course for the qualification of trained nurse. A nursing orderly, class I, accepted for training for the higher qualification of Army trained nurse is assigned to a selected hospital for a further year of training under the control of a sister tutor. Acceptance for this training involves special selection and the fulfillment of various educational and service conditions. The curriculum is the same as that laid down for the final stage of nurse training in civilian training hospitals and the qualifying examination is comparable to the State final examination. Before a soldier can be graded as an Army trained nurse he must have completed 3 years' actual nursing in acute wards in addition to

passing the examination and fulfilling certain other conditions. A holder of the Army trained nurse qualification is eligible to take the State examinations without additional training and so can become a State registered nurse while serving as a soldier.

FUNCTIONS OF THE NURSING ORDERLY

Nursing orderly, class III, is the basic trade qualification of the R. A. M. C. (and of the Q. A. R. A. N. C.) and is required for advancement to class II in any of the trades of the Corps. This condition applies to both regulars and National Servicemen. The outcome is that every class II tradesman in the Corps, no matter what his personal trade may be, has been trained in basic nursing duties and in an emergency can take his place in a hospital ward. In addition, R. A. M. C. soldiers employed in various domestic and administrative functions are expected to hold at least the class III nursing orderly qualification so that they may be available for ward duty if required.

Hospital nursing is not the only technical commitment of the R. A. M. C. nursing orderly. The care of casualties in the field is an equally important part of his training and responsibilities. The two main targets for the ambitious nursing orderly are the trained nurse qualification and the trade of operating theater technician. Opportunities are available, however, for various forms of specialization such as neurosurgical, maxillofacial, thoracic, and ophthalmic nursing. Although the soldier is recorded officially as trained and experienced in such specializations, he remains a nursing orderly and has to be prepared to perform any of the other duties of his trade when the occasion arises.

Mental nursing orderly. This is the only trade concerned with the care and nursing of mental illness. The training follows a pattern of progressive instruction and practice while the trainee is employed in the duties of the trade. There are examinations for initial grading and advancement and it takes 3 years to attain a class I qualification. There is no fourth year course of any higher qualification, but a proportion of the regular mental nursing orderlies achieve the State civil qualification. The mental nursing orderly may specialize in occupational therapy or in the care and management of patients receiving insulin therapy.

Special treatment orderly. This trade has been shorn of much of its former attraction as a highly skilled occupation by the recent advances in the treatment and management of venereal diseases. These technicians are trained in the clerical and clinical laboratory duties of a venereal disease clinic as well as in the treatment of all forms of venereal disease and the nursing of inpatients. They do not, however, undertake cultural or serologic investigations. The training is received through progressive instruction and practice while the trainee is employed in venereal disease clinics. Examinations for initial grading and advancement are given. It takes 3 years to reach the class I qualification. There are no specializations within the trade.

Operating theater duties. The operating theater technician is a class I nursing orderly who has been trained subsequently for special technical duties. These include the servicing of cutting instruments and minor repairs to other surgical and electrical equipment in addition to active membership in the surgical team, before, during, and after operations. The training includes instruction by a cutler as well as an apprenticeship training in the operating theater.

Transfusion. There is no separate trade of transfusion orderly except in war. Under peace conditions selected nursing orderlies are trained in transfusion duties as a specialization but their trade remains nursing orderly. The course includes relevant elementary laboratory work as well as training in the clinical procedures of transfusion. It may be noted in passing that the laboratory work of a transfusion center is normally performed by laboratory technicians with special training in this branch. Under war conditions nursing orderlies trained in transfusion duties are graded as "transfusion orderlies" and relinquish their nursing orderly status.

OTHER TRADES CONCERNED IN MEDICAL CARE AND TREATMENT

Radiographer. The primary function of the R. A. M. C. radiographer is diagnostic radiography. The instruction includes the basic principles of radiotherapy, but practical training in this branch of x-ray technic is regarded as a specialist training and is normally only undertaken by radiographers already qualified otherwise. Other specialties in this trade are mass miniature radiography and clinical photography. The basic technical training of all radiographers is a 4-month course in the Army X-Ray School at the end of which successful candidates are graded as class III radiographers and are assigned to x-ray departments for a continuation of their training. Progress to class I takes another 2 years and includes examinations for advancement to class II and class I. The class I qualification is recognized by the Society of Radiographers and exempts the holder from part of the final examination for membership in the Society.

Physiotherapy. The training for physiotherapist, class III, is a 10-month course at the Army School of Physiotherapy and is the longest of the R. A. M. C. technical courses. The curriculum includes the various radiation and electrotherapeutic technics as well as massage and remedial exercise. Two years' work as a physiotherapist are required for progression to class I.

Chiropodist and optician. These auxiliaries are not trained in the service. The requirement is met by the enlistment of men already trained and qualified under civil arrangements.

LABORATORY AND PUBLIC HEALTH

Laboratory technician. Most of the National Servicemen selected for this trade were student medical laboratory technicians in civil life and have already had material training and experience. The training of a

National Serviceman for class III is normally carried out in a working laboratory. In the 3-month course the main emphasis is on bacteriology and pathology. The common procedures of clinical biochemistry are included but public health chemistry is omitted at this stage. The regular, on the other hand, undergoes an initial 8 months' training at the Royal Army Medical College. The curriculum includes routine public health chemistry as well as clinical biochemistry in addition to bacteriology and pathology.

It takes at least 20 months' further work to attain the class I qualification. This qualification is recognized by the civilian Institute of Medical Laboratory Technology as a stage toward the associateship of the Institute which is the target of the ambitious laboratory technician.

A laboratory technician may undertake additional training in entomology. This is usually taken after attaining class I status. Many senior laboratory technicians have acquired special skill in some branch of laboratory technic but whether this be entomology, food or water chemistry, histology, physiology, or any other line, the specialty does not affect the soldier's status or title or his availability for other forms of medical laboratory duty.

Hygiene assistant. This tradesman, until recently called a sanitary assistant, is in effect a preventive medicine technician and is the military counterpart of the civilian sanitary inspector. The training for class III is a 3-month course at the Army School of Health and a further 2 years' work is required to attain class I. Specialization in entomologic duties may be undertaken as an additional activity but does not affect the soldier's status.

PHARMACY AND DISPENSING OF MEDICINES

The *pharmacist* is a soldier who has obtained a recognized civil qualification in pharmacy prior to enlistment. Apart from a short course in medical equipment accounting, he does not receive technical training in the Army.

A *dispenser* is a soldier trained in the service as a dispenser of medicines. Normally he has already qualified in some other trade before he is accepted for training as a dispenser. Up to the present, the course has comprised a preliminary phase of 6 months' part-time training in the elements of dispensing procedure, medical equipment accounting, and control of poisons, after which successful candidates proceed to a 4-month whole-time course at a R. A. M. C. School of Dispensing. The qualification carries class I status. This trade is to be changed in the near future to a 3 classes trade with a longer period in the School of Dispensing and a subsequent phase of apprenticeship in a hospital dispensary before attaining the full qualification. Pharmacists and dispensers in general are interchangeable except for certain specialist appointments reserved for pharmacists.

THE CLERICAL TRADES

Clerk (R. A. M. C.) and clerk orderly (clinical) are peculiar to the R. A. M. C. The clerk (R. A. M. C.) is trained for R. A. M. C. clerical duties and is not interchangeable with clerks of other corps. The training is planned to develop versatility. It takes nearly 3 years to reach class I, by which time the soldier has had training and experience in the work of every kind of office in the Medical Service, including staff work. The clerk orderly (clinical) is primarily intended to function as a clinical secretary and stenographer for a commissioned medical specialist. Although a specially skilled occupation, this trade by itself has a somewhat limited career appeal. A number of the regular clerks now train concurrently as clerk orderly (clinical) and clerk (R. A. M. C.).

MEDICAL SUPPLY

The *surgical instrument mechanic,* properly "instrument mechanic (surgical)," is a technician who has joined the R. A. M. C. after completing his technical training with one of the surgical instrument manufacturing firms. These technicians are employed in major medical equipment depots on surgical instrument repair and reconditioning.

The *technical storeman,* properly "storeman (technical) R. A. M. C.," is a soldier trained for special duty in a medical equipment depot. The training for class III is a 4-month course at the main Army Medical Equipment Depot and covers the various aspects of warehouse procedure and stock control and the assembling and packaging of various categories of medical supplies for consignment by road, rail, sea, and air. Two further years of experience and training are required to obtain the class I qualification. This trade offers a special career attraction in that the technical storeman can be employed in his trade in every rank up to that of warrant officer with the prospect of obtaining his commission as a medical equipment branch officer and the possibility of ultimately attaining the rank of lieutenant colonel.

CAREER ASPECTS

Career as a soldier. Military promotion in the regular R. A. M. C. is on a corps basis. There is only one promotion ladder for the whole Corps and seniority as a tradesman does not by itself affect the military rank of the enlisted soldier. At each step in military rank the candidate's eligibility for promotion is governed by (1) his status as a tradesman, (2) his standard of general education, and (3) his possession of the military knowledge required in the prospective rank.

Furthermore, at each step the candidates eligible for promotion are arranged in 3 queues called priority I, II, and III, those in priority III holding the basic qualifications for the promotion and those in priorities I and II holding certain higher educational and technical qualifications. A candidate "queueing" in priority III can change to priority II

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and I on acquiring the appropriate higher qualifications. This system offers opportunity for accelerated promotion to the talented soldier who is prepared to make the best use of his gifts and his time. The R. A. M. C. soldier who possesses the necessary qualities can attain commissioned rank as an administrative and technical officer, a quartermaster, or a medical equipment branch officer.

Career as a technician. Although military promotion in the R. A. M. C. is primarily regimental, the establishment of the Corps provides appointments in all trades up to the rank of sergeant, and, in some trades, appointments for staff sergeants and warrant officers as well. This does, in effect, afford such tradesmen a form of career ladder within the trade itself, but this is incidental rather than planned. For example, a clerk R. A. M. C. may serve in a clerical capacity up to the rank of warrant officer, class I. In some trades there is the opportunity for promotion in due course to commissioned rank in the same technical field. In such cases, although the promotion through the various ranks up to warrant officer is dependent at each stage on educational and regimental factors as well as on technical progress, it is in fact his special quality as a technician which determines the axis of the soldier's career and leads in the end to his commission.

Education in the R. A. M. C. The educational factor in promotion in the R. A. M. C. deserves a brief explanation. Although a material proportion of the men who take regular engagements in the Corps are up to university entrance standard at enlistment, many have had only an elementary education and are ill-equipped to undertake technical training involving scientific theory. The Army provides good facilities for general education, however, and the soldier who has the basic talent and the determination can retrieve his broken education and progress up to university entrance standard and beyond.

THE Q. A. R. A. N. C.

The Q. A. R. A. N. C. acquired its own enlisted ranks establishment in July 1950. Previously this Corps had consisted of commissioned nurses only, the subordinate staff in the military wards being R. A. M. C. soldiers. During World War II and subsequently these R. A. M. C. soldiers were supplemented and partly replaced by members of the Voluntary Aid Detachments (female) and by women orderlies of the wartime Auxiliary Territorial Service or of the more recent Women's Royal Army Corps or "W. R. A. C." Now the subordinate nursing staff in the military wards is composed of R. A. M. C. and Q. A. R. A. N.C. nursing orderlies. The role of the latter Corps, however, is not limited to nursing and many of the R. A. M. C. trades are open also to women of the Q. A. R. A. N. C.

It may be added that the women of the Q. A. R. A. N. C. are enlisted in the same way as the regular R. A. M. C. soldier, that their trade training is identical except for minor details and that in many cases the

tradesman and tradeswoman are trained together. The tradeswoman has the same opportunity as the tradesman of attaining the recognized civil qualifications and both have the same facilities for continuing their general education. Finally the promotion system in the Q. A. R. A. N. C. is constructed on the same principles as that of the regular R. A. M. C., with 3 grades of queue for every step in promotion and with military, educational, and technical factors operating at each of them.

CONCLUSION

In the foregoing description of the R. A. M. C. tradesman and the Q. A. R. A. N. C. tradeswoman, details have been avoided as far as possible because these are constantly changing. The account which has been given is intended to present a general picture which can be accepted as a relatively static one.

BOOK REVIEW

Psychological Factors of Peace and War, edited by *T. H. Pear.* Contributions by *G. W. Allport, J. Cohen, H. V. Dicks, H. J. Eysenck, J. C. Flugel, Hilde Himmelweit, Madeline Kerr, T. H. Pear, L. F. Richardson.* 262 pages. The Philosophical Library, Inc., New York, N. Y., publishers, 1950. Price $4.75.

Professor Pear has performed an excellent service in collecting and editing a series of professional papers concerning the cause of war. Under the sponsorship of the United Nations Association, eminent psychiatrists, sociologists, and psychologists of England and the United States pooled their contributions into a meaningful unit. This book requires no broad technical knowledge of psychology, although familiarity with methods of psychologic research is helpful in understanding the last 4 chapters.

Provocative inquiries are presented and scientific hypotheses are proposed as areas for consideration and further investigation. A good case is made for education of the public; research evidence is overwhelming in demonstrating the severe lack of agreement between social scientists and the lay population (voters) concerning the causes of war. The relative readiness of man to accept war as being inevitable is put to searching inquiry by Dr. Himmelweit and comes out a poor second. The role of the concept of aggression apparently needs further study to close the gap between laboratory findings and real situations confronting a social group. The popular trend in assigning "typical characteristics of a nationality" is denounced with professional clarity by Dr. Dicks with a summary of psychiatric research on the topic.

Dr. Richardson epitomizes the tone of the volume in stating that general statements can be examined, verified, or denied by collecting the facts from the entire world over a century or more. Typical developments of group responsiveness to threat (from another group), with reactions of contempt, submission, negotiation, avoidance, or retaliation are cited from recent happenings well within memory span of the reader. Professor Kerr proposes that extensive studies be made of societies in which prestige is given a high value as well as of the relation between economic factors and psychologic elements.

Dr. Flugel succinctly illustrates why the reliance of the League of Nations, and now the United Nations, on an intellectual appreciation of their necessity largely explains their lack of success. Professor Allport makes a strong appeal for social research focused on concurrent and interlocking problems of nations for the purpose of enhancing international cooperation. Such efforts may well be centered on education, child welfare and health because "adults are the bigots." Propaganda also needs further scientific appraisal to further international unity and to prevent war. A wealth of material has here been compressed into a relatively few pages. This book is recommended without reservation for wide reading. —*Lt. Col. F. A. Zehrer, MSC, U. S. A.*

Dible and Davie's Pathology, An Introduction to Medicine and Surgery, by *J. Henry Dible,* M. B. (Glas.), F. R. C. P. (Lond.), Professor of Pathology in the University of London (Post-Graduate Medical School of London); Late Professor of Pathology at the London School of Medicine for Women; Professor of Pathology in the Welsh National School of Medicine; and Professor of Pathology in the University of Liverpool. 3d edition. 963 pages; 417 illustrations including 9 plates in color. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1950.

This book is based on lectures delivered by the authors to medical students. The writers point out that they have endeavored to discuss the most important processes at the greatest length. This arbitrary selection of subject material has resulted in the exclusion of such diseases as scleroderma, lupus erythematosus and dermatomyositis. The arrangement of the book follows a system which the authors found convenient in teaching. Inflammation and the basic processes of pathology are dealt with in the first section; special infections, in the second; and systemic pathology, including the important pathologic processes not previously discussed, in the third. The authors have stressed the natural history of disease in the hope of stimulating the student to think. The addition of a bibliography would be of use to those students wishing to review original reference material. Some of the illustrations are excellent and a few are of doubtful value. Figure 80 leaves the impression that papillomatous warts are due to scratching. The book should be valuable chiefly to medical students.—*E. B. Helwig, M. D.*

Terramycin in Tuberculous Otitis Media

Leon L. Titche, *Major, MC, U. S. A. R.* (1)

THE discovery of terramycin by Finlay and his co-workers (2) was followed by the investigation of its antibiotic properties by them and numerous other workers (3-9) who showed that the substance was effective against diseases caused by many of the aerobic and anaerobic gram-positive and gram-negative bacteria, the rickettsias and certain viruses. The first work on the use of terramycin in tuberculosis was by Hobby (10) who found that it suppressed experimental tuberculous infections in guinea pigs and mice. This was confirmed by Steenken and Wolinsky (11) who also showed that it was effective against streptomycin-resistant strains of the tubercle bacillus in experimental ani-

(1) Veterans Administration Hospital, Tucson, Ariz.

(2) Finlay, A. C.; Hobby, G. L.; P'an, S. Y.; Regna, P. P.; Routien, J. B.; Seeley, D. B.; Shull, G. M.; Sobin, B. A.; Solomons, J. A.; Vinson, J. W.; and Kane, J. H.: Terramycin; new antibiotic. Science 111: 85, Jan. 27, 1950.

(3) Herrell, W. E.; Heilman, F. R.; Wellman, W. E.; and Bartholomew, L. G.: Terramycin: some pharmacologic and clinical observations. Proc. Staff Meet. Mayo Clin. 25: 183-196, Apr. 12, 1950.

(4) Hoffman, M. S.; Wellman, W. E.; and Herrell, W. E.: Failure of absorption of aureomycin and terramycin administered as retention enema. Proc. Staff Meet. Mayo Clin. 25: 463-464, Aug. 2, 1950.

(5) King, E. Q.; Lewis, C. N.; Welch, H.; Clark, E. A., Jr.; Johnson, J. B.; Lyons, J. B.; Scott, R. B.; and Cornely, P. B.: Clinical observations on use of terramycin hydrochloride. J. A. M. A. 143: 1-4, May 6, 1950.

(6) Melcher, G. W., Jr.; Gibson, C. D., Jr.; Rose, H. M.; and Kneeland, Y., Jr.: Terramycin in treatment of pneumonococcic and primary atypical pneumonia. J. A. M. A. 143: 1303-1308, Aug. 12, 1950.

(7) Parry, E.: Newer therapeutic agents. South Dakota J. Med. & Pharm. 3: 189-190, June 1950.

(8) Pratt, P. T.: Preliminary report on use of terramycin in pneumonia. Nebraska M. J. 35: 294-295, Sept. 1950.

(9) Werner, C. A.; Knight, V.; and McDermott, W.: Absorption and excretion of terramycin in humans; comparison with aureomycin and chloramphenicol. Proc. Exper. Biol. & Med. 74: 261-267, June 1950.

(10) Hobby, G. L.: Tuberculostatic activity of terramycin and viomycin. Proc. Ninth Streptomycin Conference. pp. 192-198, 1950.

(11) Steenken, W., Jr., and Wolinsky, E.: In vitro and in vivo antituberculous activity of terramycin and viomycin. Proc. Ninth Streptomycin Conference. pp. 189-192, 1950.

mals. Youmans *(12)* studied the effectiveness of the antibiotics in experimental tuberculosis in mice and found others to be superior to terramycin. Knight *(13)* reported that terramycin was not effective against tuberculosis in man. Bunn *(13)* reported beneficial effects in a few patients and at the Tenth Streptomycin Conference in January 1951 radiologic improvement was reported in 12 of 15 patients and sputum conversion in 5 under terramycin therapy by one of the reporting hospitals.

The following case is being reported solely to bring out the fact that improvement followed terramycin therapy in a patient with tuberculous otitis media in whom the organisms were resistant to streptomycin. In the patients reported in the literature, terramycin was given by mouth. In the case presented here, it was applied locally, using the same method by which streptomycin had been given in a previous series of patients *(14)*.

CASE REPORT

A man, 27 years of age, entered the hospital on 12 June 1949 with a diagnosis of tuberculosis, pulmonary, chronic, reinfection type, far-advanced, of about 3 months' duration. A roentgenogram of his chest revealed lesions in both upper lobes of the caseocavernous type. His sputum was positive for tubercle bacilli on smear and culture. One gram of streptomycin was given twice a day for 2 weeks followed by 1 gram daily for 4 months because the organisms were sensitive to a concentration of less than 1 microgram per cc. Practically no improvement was noted clinically or on roentgenologic examination and the organisms were found to be resistant to a concentration of streptomycin between 10 and 100 micrograms per cc. at the end of antibiotic therapy. A temporary crushing of the left phrenic nerve was performed on 27 October. Pneumoperitoneum was started and has been continued. Roentgenograms have shown essentially no change during his course in the hospital.

On 2 October 1950 the patient complained of a discharge from his left ear. Examination revealed the external canal to be filled with mucopurulent material. The tympanic membrane showed a large perforation posteriorly and inferiorly. The middle ear was filled with mucopurulent secretion. Direct smear did not yield acid-fast bacilli, but a culture of the material revealed such organisms, which proved resistant to streptomycin in a concentration between 10 and 100 micrograms per cc. Before a report was received on the culture penicillin was given parenterally and locally without any improvement so 0.1 gram of streptomycin

(12) Youmans, G. P.: Comparative effectiveness of chemotherapeutic agents upon experimental tuberculosis of mice. Proc. Ninth Streptomycin Conference. pp. 198-199, 1950.

(13) Knight, V.: Clinical evaluation of aureomycin, chloramphenicol, and terramycin. (discussion by Bunn, P. A.) New York State J. Med. 50: 2173-2181, Sept. 15, 1950.

(14) Titche, L. L.: Streptomycin in treatment of tuberculous otitis media; evaluation. Arch. Otolaryng. 51: 826-830, June 1950.

was instilled locally into the ear daily in the hope that the organisms in the ear were not streptomycin-resistant like those in the sputum. Roentgenologic examination revealed an infected mastoid process on the left side and re-examination 4 weeks later showed that the involvement had progressed. On 29 November 50 mg. of terramycin in 1 cc. of distilled water was instilled locally into the left ear daily. On 3 January 1951 the ear was found to be dry and has remained so. An applicator was inserted into the middle ear on 10 January in an attempt to obtain material for smear and culture for acid-fast bacilli and these examinations were negative for organisms. A roentgenogram taken on 9 January revealed clearing of the mastoid cells on the left. The patient at this time had no complaints referable to his ears.

SUMMARY

Tuberculous otitis media and mastoiditis was caused by organisms that were resistant to streptomycin in a patient in whom the infection progressed under streptomycin therapy. When terramycin was employed locally the otitis and mastoiditis cleared up.

BOOK REVIEW

Obstetrical Practice, by *Alfred C. Beck,* M. D., Professor Emeritus of Obstetrics and Gynecology, State University of New York, College of Medicine at New York City; formerly Professor of Obstetrics and Gynecology, Long Island College of Medicine; formerly Obstetrician and Gynecologist-in-Chief, Long Island College Hospital; Consultant in Obstetrics and Gynecology, Long Island College Hospital and Norwegian Hospital, Brooklyn, N. Y., U. S. Naval Hospital, St. Albans, N. Y., Vassar Brothers Hospital and St. Francis Hospital, Poughkeepsie, N. Y. 5th edition. 1073 pages; with 969 illustrations. The Williams & Wilkins Co., Baltimore, Md., publisher, 1951. Price $10.

This book takes into account the many advances made in obstetrics since the publication of the fourth edition. Most of the new edition has been rewritten and many new illustrations have been added. A new feature is an appendix consisting of 22 roentgenograms. Gillam's recent observations have been incorporated in the chapter on the development of the ovaries along with those of Corner and Brewer. The work of Markee, Daron, Schagel, Daalgard, Fluhmann, and Haman on menstruation, and that of Heuser, Streeter, Hertig, and Rock on the developing fertilized ovum, have been given recognition. The chapter on the physiology of the fetus has been revised to include the work of Barcroft and Barron and of Snyder and Rosenfeld on the respiratory movements of the fetus. Barcroft's reports on blood and circulation have been incorporated in this chapter in addition to Gruenwald and Popper's studies

of the kidney. The chapter on the changes taking place in the mother during pregnancy has been extensively revised. Of particular note are the changes suggested by the studies on the isthmus and cervix by Ivy, Danforth, and Stieve. There is an adequate description of the newer tests for pregnancy.

The chapter on management of pregnancy stresses the role of diet during pregnancy. The growing importance of pelvimetry is emphasized. The revised chapter on presentation and posture is accompanied by a new set of illustrations. In describing the stages of labor and their management the author makes a strong plea for conservative treatment in the third stage.

The chapter on medical and surgical complications of pregnancy replaces the older one on the toxemias of pregnancy and includes a discussion of the Rh factor, hypertensive vascular disease, phlebothrombosis, rubella, and the modern treatment of syphilis with antibiotics. The newer concepts of uterine inertia and use of posterior pituitary extract for this condition is ably discussed. The recommended management of placenta praevia has been changed to conform with the observations of Williams, Macafee, and Johnson. This book should be of great value to undergraduates and young practitioners.

—*Lt. Col. H. L. Riva, MC, U. S. A.*

Administrative Housekeeping, by *Alta M. La Belle,* Consultant on Housekeeping and Interior Design, former Director of Housekeeping, Michael Reese Hospital, Chicago, and *Jane Barton,* Associate Editor, The Modern Hospital. 420 pages; illustrated. G. P. Putnam's Sons, New York, N. Y., publishers, 1951. Price $5.50.

The authors of this book have presented in an easily readable style an exposition of the modern philosophies of industrial psychology and personnel management as applied to the field of institutional housekeeping. This book, however, is much more than a philosophical treatise in that it provides a practical approach to the solution of the everyday problems met by those responsible for the maintenance of hospital facilities. To quote the authors, "Theoretical knowledge is worthless unless methods of application are also understood and carefully followed." An excellent index provides a ready means of finding the answer to almost every conceivable problem confronting the institutional housekeeper whether he is the maintenance officer of a military hospital or a member of the administrative staff of a civilian hospital. This book should fit nicely into the curriculum of schools of hospital administration and is a valuable contribution to the libraries of hospital administrators and housekeepers.—*Capt. C. R. Wilcox, MC, U. S. N.*

Intestinal Obstruction[1]

Marshall N. Jensen, *Colonel, U. S. A. F. (MC)*

Irving K. Ettman, *Lieutenant Colonel, U. S. A. F. (MC)*

THE mortality rate of intestinal obstruction has been greatly reduced as a result of its earlier recognition and the use of more rational therapy. Difficulty in diagnosis is frequently encountered, especially in patients of the younger age group or when the acute phase is made obscure by insidious onset and vague symptoms. Recognition and proper treatment of intestinal obstruction require special consideration of the various clinical types. The causes of intestinal obstruction may be mechanical or paralytic. Wangensteen (2) calls the latter inhibitive. Three cases of intestinal obstruction are reported here because of unusual features observed in each.

CASE REPORTS

Case 1. A 21-year-old man was admitted to this hospital on 6 June 1951 because of severe abdominal pain, obstipation of 4 days' duration, and progressive distention of the abdomen. Paroxysmal cramping abdominal pains were occurring at intervals of from 1 to 2 minutes. Since childhood the patient had experienced episodes of abdominal pain coming on about 2 hours after meals and subsiding gradually. He gave no history of constipation. He had noticed that his abdomen would become greatly distended when flying at altitudes of over 20,000 feet. In 1949 a routine roentgenogram of the chest (fig. 1) showed a marked distention of the colon, and one of the abdomen at that time revealed evidence of a megacolon.

Physical examination on admission revealed marked distention of the abdomen with increased peristalsis and visible peristaltic waves in the left upper abdominal quadrant. The latter were synchronous with the crampy abdominal pains. The pulse was rapid and the white blood cell count elevated. A roentgenogram of the abdomen revealed a tremendously enlarged loop of large bowel which extended across the entire abdomen from right to left and another loop of colon distended with gas and lying just beneath the first loop and separated from it

(1) Air Force Hospital, March Air Force Base, Calif.

(2) Wangensteen, O. H.: Intestinal Obstructions. 2d edition. Charles C Thomas, Publisher, Springfield, Ill., 1945. p. 151.

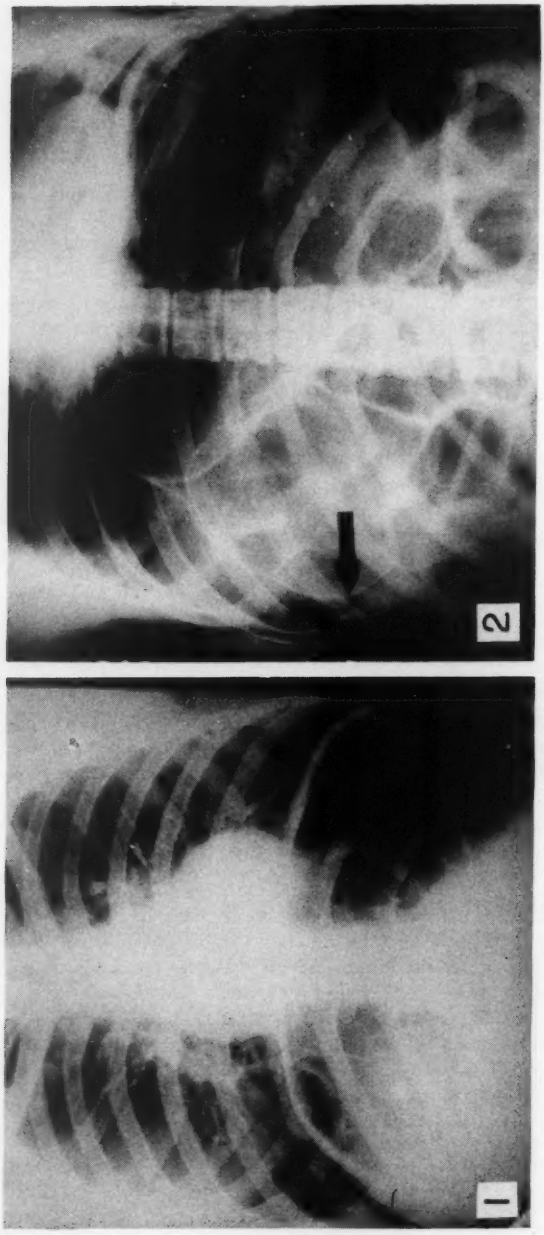

Figure 1 (case 1). Roentgenogram of the chest showing gaseous distention of the colon. Figure 2 (case 1). Roentgenogram taken after operation.

in the left upper abdominal quadrant by a narrow loop of colon. A diagnosis of megacolon with volvulus was made.

An exploratory laparotomy was performed and a volvulus was found at the juncture of the descending and sigmoid colon. The transverse colon was distended to a diameter of about 18 inches. The volvulus was released, the distal 7 inches of descending colon and proximal 7 inches of the sigmoid were removed, and an end-to-end anastomosis was performed. Ten days later a transverse colostomy was performed because of suspected leakage from the anastomosis. Later a closure of the colostomy with end-to-end anastomosis was performed and the patient became and remained free of symptoms. A roentgenogram taken several days after operation (fig. 2) showed the enlarged colon and the presence of air in the peritoneal cavity.

Case 2. A 26-year-old woman was admitted to this hospital on 14 May 1951 because of cramping upper abdominal pain and tarry stools of 3 days' duration. Her red blood cell count was 2,000,000 and the hemoglobin 6.5 gm. Since 1940 she had had 5 episodes of thrombophlebitis involving the veins of the lower extremities. The initial episode was at the age of 16 and followed an appendectomy and removal of an ovarian cyst. Three pregnancies have subsequently occurred, each associated with thrombophlebitis. A cholecystectomy in 1944 was followed by a 2-month period in bed, at which time a vena cava ligation was considered but not performed. In May 1950 marked abdominal swelling, associated with cramping pain and tarry stools, had occurred. This episode subsided in 1 month without hospitalization, and no diagnosis was made.

In the 6 days following admission, blood transfusions totaling 4,500 cc. were given and her condition improved. On the third hospital day, marked abdominal distention developed. A paracentesis revealed that this was due to ascites. She was placed on a low salt diet and given a mercurial diuretic following which she improved. A gastrointestinal series suggested esophageal varices. Liver function tests were within normal limits. A tentative diagnosis of portal hypertension secondary to portal vein thrombosis was made, and a splenorenal shunt was planned. Because of the continuous cramping abdominal pain in the early days of this illness, it was thought that some degree of mesenteric thrombosis was present.

The patient was discharged from the hospital on 28 May, but returned on 1 June with abdominal distention, cramping pain, vomiting, and bloody stools. A fluid wave was present in her abdomen; her pulse was 120; and her temperature was 100° F. On 4 June a roentgenogram of the abdomen in the erect position revealed numerous loops of small intestine containing gas-capped fluid. Valvulae conniventes within the bowel were also noted (fig. 3). An x-ray diagnosis of small intestinal obstruction was made.

On 4 June a right paramedian incision was made. On opening the peritoneal cavity, blood-tinged fluid escaped. The small bowel was gangrenous from 12 inches distal to the ligament of Treitz to 3 feet proximal to the ileocolic junction. The mesenteric veins were thrombosed but the arterial supply was intact. Resection and end-to-end anastomosis was performed at the ligament of Treitz, leaving about 2 feet of ileum. The spleen and liver were not enlarged and appeared to be normal. The patient's postoperative course was smooth. A postoperative diagnosis of small intestinal obstruction due to thrombosis of the mesenteric veins was made.

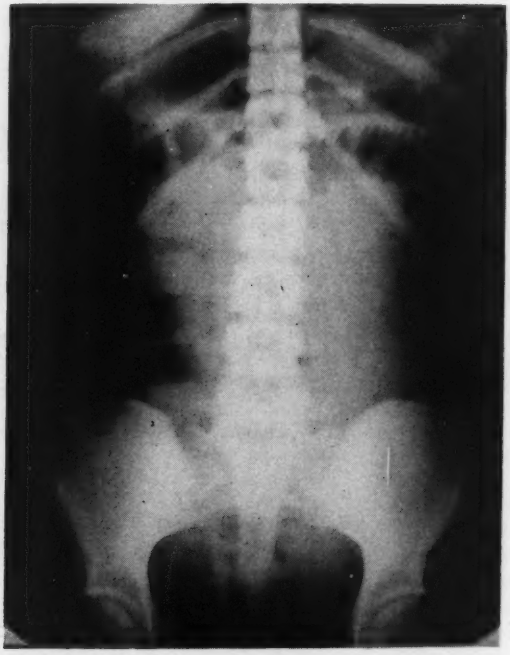

Figure 3 (case 2). Roentgenogram taken before operation showing the gas-distended loops of small intestines. Cross striations of mucosal folds or valvulae conniventes are noted in the jejunum.

Case 3. A 4-year-old boy was admitted to this hospital on 25 March 1951, 24 hours after a concrete bird bath had fallen across his abdomen. He complained of abdominal pain. His temperature was elevated and there was clinical evidence of an adynamic ileus. Physical examination revealed marked tenderness and abdominal rigidity. The abdomen was slightly distended with no definite evidence of shifting dullness. A roentgenogram on 26 March (fig. 4) revealed multiple loops of small

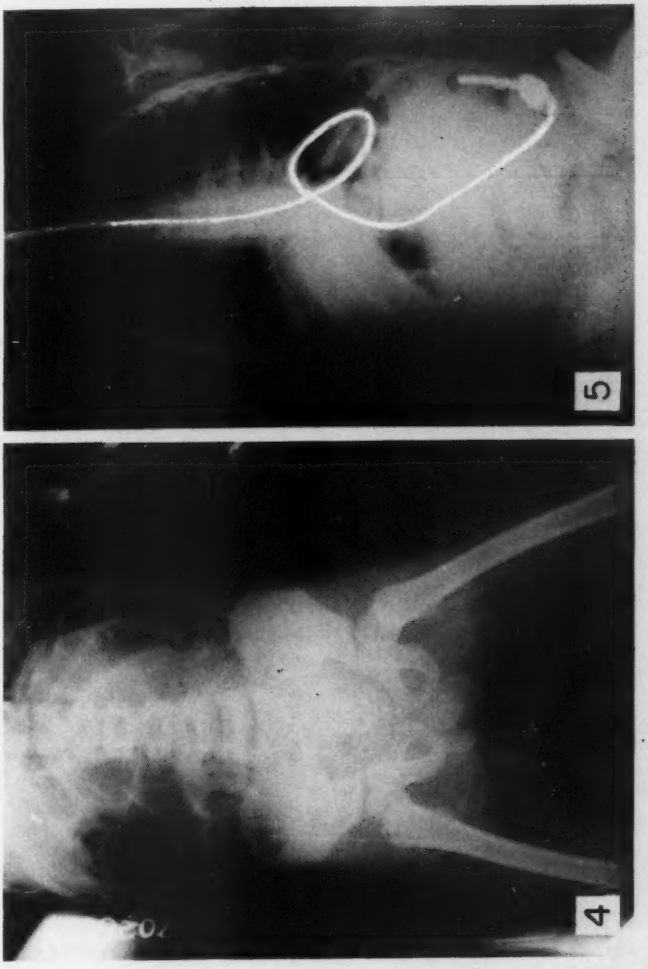

Figure 4 (case 3). Roentgenogram of the abdomen showing gaseous distention of intestines. Figure 5 (case 3). Roentgenogram taken on readmission revealing the gas-capped fluid levels in the small intestine and the tip of the Miller-Abbott tube at the site of the obstruction.

and large bowel distended with gas, but no evidence of free air under the diaphragm. A tentative diagnosis of ileus, secondary to trauma was made.

Conservative treatment with a Miller-Abbott tube and Wangensteen suction apparatus, intravenous fluids, and antibiotics resulted in gradual recovery. On the eleventh day after injury, the patient passed several loose stools, including whole corn kernels eaten the day before injury. The patient was discharged on the following day, symptom free. One month after injury he was readmitted because of abdominal distention, persistent vomiting, and visual evidence of hyperperistalsis. A roentgenogram of the abdomen (fig. 5) revealed small gas-capped fluid levels in the small intestine. A diagnosis of small bowel obstruction was made.

On 26 April a laparotomy was performed and a healed rupture at the jejuno-ileal junction was found. This was the site of an old abscess. Nearly complete obstruction of the small intestine was present at this point, but the bowel was definitely viable. Resection of 4 inches of small intestine was performed and end-to-end anastomosis was made. The postoperative course was uneventful. The postoperative diagnosis was intestinal obstruction, secondary to previously ruptured small intestine and resulting cicatrix.

DISCUSSION

Volvulus associated with megacolon is unusual, but is common enough that it should be considered. Golden *(3)* stated that he had seen only 2 cases and found it impossible to determine whether the megacolon was secondary to the repeated twists in the sigmoid, or the volvulus developed in the already dilated colon. The treatment is usually surgical, but Brown and Ross *(4)* reported 4 cases relieved by nonsurgical methods.

Thrombosis of the mesenteric veins leads to paralytic obstruction in the small intestines, resulting in a distention of the involved segment with an accumulation of bloody fluid and loss of viability of the bowel wall. Trotter *(5)* collected 360 cases with mesenteric thrombosis and embolism. Arterial occlusion contributed to 60 percent of these and thrombosis of the mesenteric vessels the rest. Venous thrombosis is usually associated with infection of the abdominal organs and tributaries of the portal vein, such as appendicitis, pelvic infection, et cetera. In case 2 there was no apparent cause for thrombosis in the mesenteric veins and, in view of the previous history of frequent

(3) Golden, R. (editor): Diagnostic Roentgenology. Thomas Nelson & Sons, New York, N. Y., 1948. vol. 1, p. 343.

(4) Brown, R. B., and Ross, D.: Congenital abnormalities of intestinal rotation and mesenteric attachment; cause of intestinal obstruction in adult. Ann. Surg. 134: 88-98, July 1951.

(5) Trotter: Cited by Wangensteen, O. H.: Vascular obstruction; intestinal obstruction due to mesenteric thrombosis and embolism In Christopher, F. (editor): Textbook of Surgery. 3d edition. W. B. Saunders Co., Philadelphia, Pa., 1942. p. 1215.

phlebitis in the veins of the lower extremities, the thrombosis may have been spontaneous.

Blunt trauma to the abdomen resulting in strictures and adhesions of the intestines, followed at a later date by intestinal obstruction, is said to be uncommon. The usual cause of such cases is severence of the mesentery attached to a short segment of the intestine with subsequent cicatrization of the intestinal wall. The delay of symptoms of obstruction in the small bowel is due to the fluid nature of the intestinal contents. Narrowing of the lumen must be almost complete before symptoms develop.

SUMMARY

Three cases of intestinal obstruction have been presented because of their unusual nature. The type of obstruction was particularly unusual in the age group in which it occurred. These cases were observed in a short space of time on a relatively small surgical service and indicate the necessity for being on the alert for intestinal obstruction.

BOOK REVIEWS

An Introduction to Modern Psychology, by *O. L. Zangwill.* 227 pages; 20 illustrations. Philosophical Library, New York, N. Y., publisher, 1950. Price $3.75.

In this compact book, Oxford University's Professor Zangwill presents a remarkably clear and concise picture of contemporary psychology. Emphasis is placed on those trends which denote the way in which "psychology is gradually taking shape as a branch of biological science," but the scope is broad enough to include a dispassionate treatment of Freudian theory, free from the blind and often impudent negations of a decade ago. The book is distinguished by its excellent literary style, which consistently reminds one of the linguistic sensitivity and skill displayed by William James. The author achieves condensation of material by combining this verbal precision with a careful selection of representative topics. As a result, no major segment of contemporary psychology is ignored.

The book proceeds from a treatment of background material, through sensory processes, learning and intellect, neural integration, appetitive and emotional phenomena, intelligence and mental measurement, psychoanalysis, and personality, to an optimistic forecast of psychologic trends in relation to neurology, the practical demands of social planning, and social science in general. The fundamental viewpoint is that of the experimentalist convinced "that the object of psychology is to understand human behaviour irrespective of what may happen to be the prevailing human situation."

Many American psychologists will not be satisfied with the rather blunt characterization of factorial methods as "a brilliant but misguided departure from the central path of empirical psychology." It is regrettable that the author did not think it necessary to temper this view by reference to the work of Thurstone, Guilford, and others. There can be no doubt, however, of the sincerity of conviction shown in this appraisal. Likewise, the author's unusually forthright stand in favor of certain hereditary influences will be met with some skepticism, but the stand itself is refreshing in an era marked by reluctance and equivocation.

The book is not "introductory" within the customary meaning of the term, for it presupposes some fundamental acquaintance with general psychology and related disciplines. Graduate students in psychology, whose minds are sometimes cluttered with conflicting details and discouraging uncertainties, will find it stimulating and reassuring. It will be informative to the educated man in science, medicine, and the humanities, yet it was written for none of these in particular, but gives the impression that it is a scholarly piece of work, done for the sake of scholarship.—*Maj. R. B. Payne, U. S. A. F. (MSC)*

711 **Medical Maxims,** by *William S. Reveno,* M. D., Assistant Professor of Clinical Medicine, Wayne University Medical College; Attending Physician, Harper Hospital; Consulting Physician, Detroit Receiving and Highland Park General Hospitals, Detroit, Mich., with forewords by *Frederick A. Coller,* M. D., and *William J. Kerr,* M. D. 197 pages. Charles C Thomas, Publisher, Springfield, Ill., 1951. Price $3.75.

This book of medical maxims was written by a physician of wide clinical experience. The maxims are concise and have direct clinical application. These aphorisms are genuine "pearls" which should be of great value to medical men in general and to interns or medical students in particular. The maxims have been arranged in accordance with the various organ systems of the body. The index occupies 74 pages of the book and is so worded as to be of aid in differential diagnosis. The binding is good and the paper nonglossy. This book is timely and contains much medical wisdom which would be most difficult to find in the usual textbooks. It can be recommended for those who wish to profit by the experience of an excellent clinician.

—*Lt. Col. B. A. Nichol, MC, U. S. A.*

Combined Pulmonary Tuberculosis and Carcinoma of the Lung

Alvin S. Hambly, Jr., *Lieutenant, junior grade, MC, U. S. N. R.* (1)

THE combination of pulmonary tuberculosis and carcinoma of the lung has been recognized for more than a century. Only in the last 25 years, however, has it been considered of distinct clinical significance. Increasingly frequent case reports, and especially the large series being reported by Farber et al. (2), has led to renewed interest in the etiologic and differential diagnostic aspects of this combination of diseases.

HISTORY

Rokitansky (3) discussed this combination from the point of view of the histologic findings and a possible etiologic relationship. His conclusions have since been the source of much discussion and are not without supporters today. Because of the difference in the general pathologic patterns of the two diseases and because of the rarity of patients showing the combination, he believed that the processes were fundamentally antagonistic. He was not the first to predicate antagonism, but he was one of the strongest supporters of this view. Among the earliest reported cases of combined pulmonary tuberculosis and lung cancer were those of Bayle (better known as Laennec's teacher) in 1810, and Friedlander in 1885 (4). The French literature of the early nineteenth century also contains pertinent case reports. Wolf reported two cases in 1895 (4). Subsequent case reports have become increasingly more frequent and inclusive of larger numbers of cases (5).

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(1) Fitzsimons Army Hospital, Denver, Colo.

(2) Farber, S. M., et al.: Personal communication.

(3) Rokitansky, C.: A Manual of Pathological Anatomy. Vol. 1. Sydenham Society, London, 1852. pp. 311-315.

(4) Hueper, W. C.: Tuberculosis and cancer. Am. Rev. Tuberc. 22: 271-285, Sept. 1930.

(5) Cooper, F. G.: The association of tuberculosis and carcinoma. Am. Rev. Tuberc. 25: 108-147, 1932.

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ETIOLOGY

In the 1928 edition of his textbook of tumor pathology Ewing *(6)* flatly stated that tuberculosis was the chief etiologic agent of carcinoma of the lung. This sweeping statement was apparently based on the findings in one series of 31 cases. This apparently provoked considerable thought as the greatest concentration of articles readily available in the literature appeared in the few years following the appearance of the text. The pertinent data may be grouped under 4 hypotheses:

1. *Carcinoma and tuberculosis are antagonistic*

This doctrine has been postulated for more than 100 years, and even prior to Rokitansky the idea was widely suggested. In late years it has been supported by the following evidence: (a) an inverse relationship appears to exist in many countries, i. e., countries having a high death rate from tuberculosis usually have a low death rate from carcinoma; (b) colored races have a low incidence of cancer, but a high incidence of tuberculosis; and (c) a general decline recently in tuberculosis mortality has been associated with a rise in cancer mortality. Many older series of carcinoma patients have been reported to show no active tuberculosis.

Additional credence to this view was given by Pearl *(7)*, who reported a study of 1,632 patients, equally divided into a carcinoma group and a control group, the latter being carefully matched with respect to age, sex, race, and approximate year of death. The only selective factor imposed on the control group was that they had no demonstrable malignancy. The study included all varieties of malignancy. The results apparently showed that a definite antagonism existed between active tuberculosis and carcinoma and that even greater antagonism was noted between tuberculosis and sarcoma. No significant difference was found in "nontuberculous" patients and those with healed gross disease. Pearl felt so strongly about this that he advocated the tuberculin treatment of carcinoma.

Fried *(8)*, however, denied that antagonism existed. He noted that the combination of these diseases is being observed more frequently clinically and that they can be reproduced experimentally in the same animal. Carlson and Bell *(9)* studied statistically 11,195 postmortem examinations with respect to frequency of occurrence of these diseases in the same patient. It is possible that their work was not inspired

(6) Ewing, J.: Neoplastic Diseases. 3d edition. W. B. Saunders Co., Philadelphia, Pa., 1928. p. 873. Also the 4th edition.

(7) Pearl, R.: Cancer and tuberculosis. Am. J. Hyg. 9: 97-159, Jan. 1929.

(8) Fried, B. M.: Bronchiogenic cancer combined with tuberculosis of lungs. Am. J. Cancer 23: 247-266, Feb. 1935.

(9) Carlson, H. A., and Bell, E. T.: Statistical study of occurrence of cancer and tuberculosis in 11,195 postmortem examinations. J. Cancer Research 13: 126-135, July 1929.

by Pearl's study, but pointed criticisms were directed at his methods. They held that the only adequate control group for a study involving carcinoma patients is not a random selection, but a group of patients with another disease. Apparently because of its prevalence, heart disease of all kinds was chosen for their control group. They found active tuberculosis to be much less frequent in cancerous than in non-cancerous subjects, and cancer to be much less common in those with active tuberculosis than in those with no tuberculosis or with healed tuberculosis. They found active tuberculosis to be even less frequently associated with heart disease than with cancer; and cancer to be less frequently associated with heart disease than with active tuberculosis.

These results do not mean that active tuberculosis inhibits the development of both cancer and heart disease. They arise from the fact that most persons with active tuberculosis have no other major illness and therefore a higher percentage of the control patients (those with no cancer or no heart disease) must always be found to have tuberculosis. These writers found no statistical evidence to support the view that there is an antagonism between cancer and tuberculosis.

2. *Tuberculosis as a precancerous lesion.*

Some experimental evidence for this view was given by Cherry *(10)* in his report on the increased incidence of all tumors including carcinomas in mice inoculated with small amounts of tubercle bacilli. This has not been successfully repeated to my knowledge. Occasional cases have been reported in support of this view *(11, 12)* but the rarity of these case reports, and the absence of large numbers of tuberculosis patients developing cancer leaves the hypothesis open to doubt *(4, 13)*. Fried *(8)* stated that, contrary to Ewing's view, carcinoma did not develop in tuberculous cavities. He believed that in cases showing this phenomenon the cancer developed in otherwise normal bronchial mucosa near the cavern and eroded secondarily into the tuberculous lesion. The hypothesis of tuberculosis as a precancerous lesion is largely discredited at this time. Even Ewing in the fourth edition of his text stated that "old tuberculosis was formerly the chief known etiological factor, but is of diminishing importance."

3. *Cancer predisposes to tuberculosis.*

Because of the known sequence of tuberculosis following cancer, attempts have been made to determine its significance. What little

(10) Cherry, T.: Tubercle bacillus and cancer in mice. M. J. Australia 1: 160-184, Feb. 9, 1929.

(11) Fulton, D., and Rolleston, C.: Bronchial carcinoma in case of pulmonary tuberculosis undergoing artificial pneumothorax treatment. Brit. J. Tuberc. 40: 129-133, Oct. 1946.

(12) Thomsen, G., and Chrom, S. A.: Case of primary lung cancer, presumably arisen from old tuberculous cavern. Acta radiol. 26: 230-238, 1945.

(13) Graham, E. A.: Pulmonary tuberculosis combined with carcinoma of lung. J. Missouri M. A. 26: 70-73, Feb. 1929.

evidence is available to support the view that cancer leads to tuberculosis is general in its scope and hard to interpret. Some authors believe that carcinomatous tissue is a good medium for the growth of tubercle bacilli. Others believe that the tissue changes in cancer prepare the road for the invasion of organisms. One frequent observation is that cancer may cause the exacerbation of a known old tuberculosis, but this may be caused by a generally lowered body resistance associated with malignant disease and not a specific biologic process. Fried noted that when tuberculosis follows cancer it is almost always in the same lung. Cruickshank *(14)* elaborated an involved "Log R law" which he believed demonstrated a causal relationship between cancer and tuberculosis.

4. *No specific relationship exists between cancer and tuberculosis.*

Carlson and Bell *(9)*, Fried *(8)* and others have concluded that the occurrence of combined pulmonary tuberculosis and lung cancer is fortuitous. Although this is a rather negative conclusion, it is consistent with the fact that most people have only one major disease. It is also supported indirectly by the apparent increase in reported combinations of these diseases associated with better diagnosis and more careful autopsy studies, a situation which should not occur if any significant antagonism existed between the disease processes.

CASE REPORTS

Case 1. A 55-year-old man was admitted to this hospital on 12 November 1947. He had malaria in 1916. At the same time he was treated for syphilis and his blood tests had been consistently negative since that time. There was no family history of contact with tuberculosis. In 1919 the patient had blood-streaked sputum, severe productive cough, night sweats, chest pain, anorexia, and weight loss. He was hospitalized at Letterman Army Hospital where a cavity was found in the upper lobe of the right lung, and the diagnosis of tuberculosis established. He left the hospital against medical advice. From that time until his admission to this hospital, he had worked as a cook, stating that he had recurrent episodes of hemoptysis, productive cough, and increase in the previous symptoms for which he was intermittently hospitalized always leaving against medical advice after a short stay in the hospital.

He gave a history of a dull aching chest pain over the entire anterior chest region which at times would radiate to his shoulders and down his left arm and hand for 5 years prior to admission here. The pain was aggravated on coughing and deep breathing. He had frequent frontal and occipital headaches which had become more severe in the 9 months prior to his entry into this hospital. Dizziness and vomiting accom-

(14) Cruickshank, D. B.: Topography of relative distribution of cancer and tuberculosis. Tubercle 21: 281-291, June 1940.

panied these headaches. The patient had become moderately orthopneic and had recurrent pitting edema of the lower extremities which disappeared on bed rest. Dyspnea on exertion was noted. He also had increasing flatulence, epigastric pain, and constipation for the year prior to his initial admission. His appetite had become increasingly poor for 6 months. There was a history of bright red rectal bleeding.

Just prior to admission he had coughed up a cupful of bright red blood. His cough was productive; he had lost weight, and had anorexia and night sweats. On admission he was noted to be a chronically ill man who appeared older than his stated age. His arteries were palpably sclerotic; his jugular veins were distended. There was a slight thrill over the cardiac apex and a loud systolic murmur heard in the apical area and in the left axilla. There was marked clubbing of the fingers with moderate cyanosis. There was decreased resonance over the left chest from the level of the sixth rib down to the diaphragm posteriorly. There were fine posttussal rales over the apex of the left lung posteriorly and in the left infraclavicular area. The breath sounds in the left axilla were amphoric. The right patellar reflex was hyperactive when compared to the left.

Four sputum specimens were positive for tubercle bacilli shortly after admission. Five 24-hour sputum specimens were studied for tumor cells and none were found. A roentgenogram of the chest showed linear parenchymal infiltration in the superior two-thirds of the right lung with possible cavitation in the supraclavicular region. There was linear nodular parenchymal infiltration involving the entire left lung. There was a cavity 3 cm. in diameter in the lateral apical region of the left lung. Patient was initially treated with absolute bed rest. Shortly following his admission his epigastric pain grew worse. He vomited and because he did not obtain immediate relief he left the hospital against medical advice. He was re-admitted on 14 February 1948 with virtually the same complaint. Streptomycin was given but this was discontinued because of pain at the site of injection. The roentgenogram of his chest is shown in figure 1. Following this the patient gradually went downhill and on 20 September while semiconscious with no acute respiratory embarrassment and no cyanosis, he died.

On autopsy the marked emaciation was noted. All lobes of both lungs were involved in a fibrocaseous tuberculous process. In addition there was a bronchogenic tumor mass in the left main bronchus and there were numerous tumor masses throughout the left lung (fig. 2). There was an old chronic empyema at the base of the left lung. Metastatic carcinomatous lesions were found in the hilar nodes, liver, and right lobe of the cerebellum. Microscopically there were fibrocaseous and caseo-nodose types of tuberculosis in all lobes of both lungs. Sections of the liver, spleen, and kidneys showed areas of caseation necrosis. Sections of the left lung showed adenocarcinoma and areas of caseation necrosis. There was also a chronic gastric ulcer.

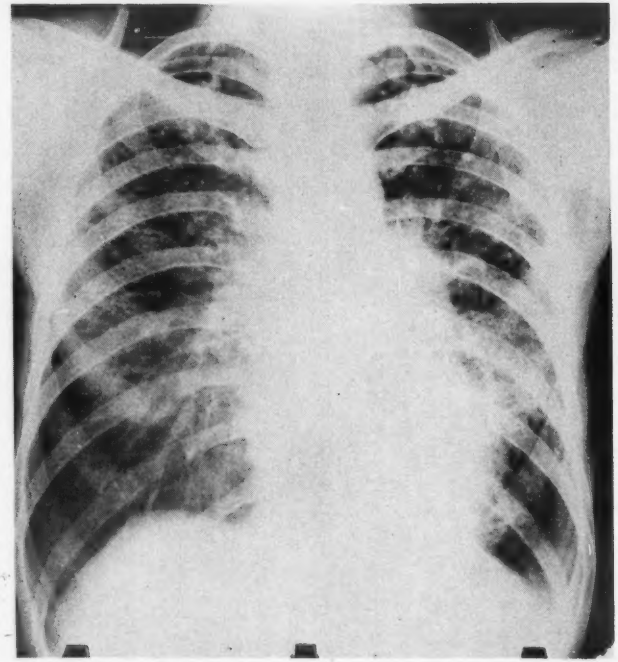

Figure 1 (Case 1). Roentgenogram taken on 17 February 1948 showing scattered productive inflammatory disease bilaterally, the left hilar mass, and the blunting of the left costophrenic angle.

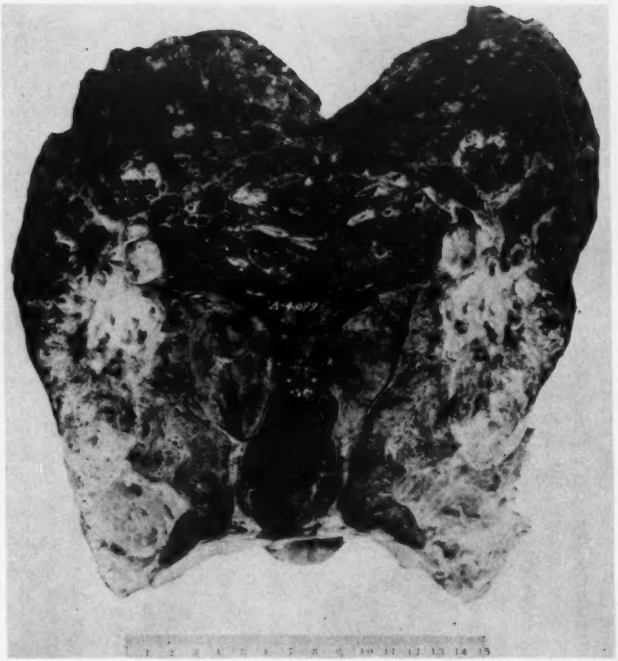

Figure 2 (Case 1). The pathologic specimen showing the centrally located tumor, the scattered fibrocaseous tuberculous lesions, and the empyema at the base.

Case 2. A 43-year-old man was admitted on 16 February 1950. He had had tuberculosis since 1934 and was admitted to this hospital following a routine roentgenogram which showed some increase in the activity of the disease. The family history revealed no contact with tuberculosis and no history of carcinoma. The patient had been hospitalized from April 1932 to June 1933, following a pulmonary hemorrhage which led to the diagnosis of tuberculosis. He had a therapeutic pneumothorax on the left side from 1933 to 1936. He was hospitalized for 10 days each on three different occasions between 1933 and 1939 for evaluation and was considered to have arrested tuberculosis. Since 1939 he had had 2 roentgenograms yearly until January 1950 when a routine film showed an increase in activity. In the 3 months prior to his hospitalization he noted slight blood streaking of his sputum and slight pain in the right side of his chest.

Physical examination on entry to the hospital showed no abnormalities. After 4 months in the hospital, a single positive gastric culture for acid-fast bacilli was obtained. It was also noted at this time that the lesion in the hilar region had continued to increase in size. Streptomycin and para-aminosalicylic acid therapy was started on 13 June 1950 after the report of the positive culture. Shortly following the initiation of chemotherapy the patient began to have nausea, dizziness, intermittent headaches, vomiting, and inability to flex his neck without pain. The chemotherapy was discontinued but the symptoms persisted. A lumbar puncture showed clear fluid with normal dynamics, but it was noted that the fluid was straw-colored. The symptoms increased and the headache recurred following an initial improvement after the lumbar puncture. Following a neurologic consultation a tentative diagnosis of tuberculous meningitis was made. The second lumbar puncture revealed an increase in the spinal fluid pressure of over 100 mm. of water. The fluid was straw-colored and slightly opalescent. Sugar was reported less than 10 mg. per 100 cc. After a second neurologic consultation the patient was still considered to have tuberculous meningitis. Chemotherapy was again instituted on 27 July. A third lumbar puncture showed the pressure to be over 600 mm. of water with slightly yellow fluid having a ground-glass appearance. On 31 July, 4 days after the start of the second course of chemotherapy, and 3 days after the third lumbar puncture, the patient experienced a sudden change in his sensorium. This was associated with a rise in the systolic blood pressure, a tachycardia, and slow deep respirations. He died on 5 August. The roentgenograms taken in 1932 showed a soft confluent infiltration with cavitation in the upper lobe of the left lung. A pneumothorax was visualized in the roentgenograms taken from 1933 to 1936. In the late 1930's a nodule was noted in the upper lobe of the left lung. This did not change in size. Through the 1940's the roentgenograms showed persistent bronchovascular markings in the left second interspace. These were first noted to be increased on 9 January 1950. By April the increase in the size of the hilar

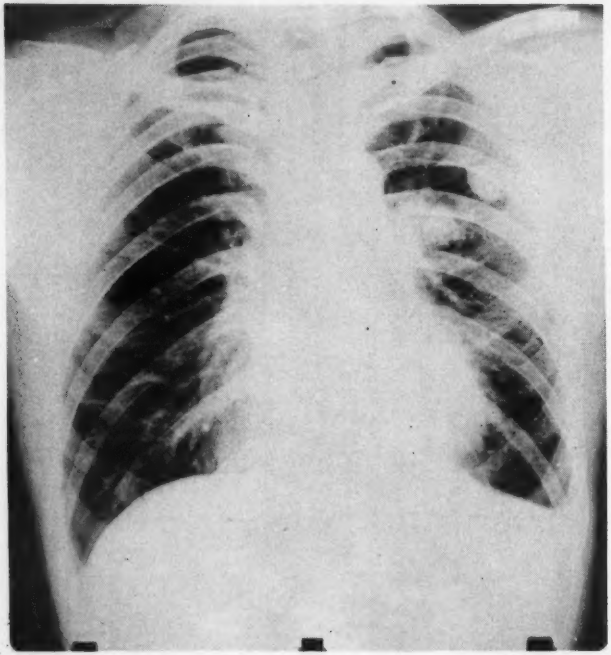

Figure 3 (Case 2). Roentgenogram taken on 14 April 1950 showing the peripheral circumscribed residual lesion of the old tuberculosis and the centrally located hilar mass.

Figure 4 (Case 2). Pathologic specimen showing the proximity of the tumor and the tuberculosis focus.

infiltration in the left lung was quite definite (fig. 3). This continued to increase.

The autopsy disclosed a primary bronchogenic carcinoma in the posterolateral bronchus of the upper lobe of the left lung (fig. 4). Metastases were found in the hilar lymph nodes, cerebral hemisphere, cerebellum and the brain stem. A tuberculoma was found in the parenchema of the upper lobe of the left lung, but no evidence of tuberculous meningitis was seen.

Case 3. A 56-year-old man was admitted to this hospital on 14 April 1949. His father and mother both died of pneumonia, type unknown. In October 1920 the patient began to have dyspnea and a cough productive of blood-streaked sputum. In January 1921 he entered the Fort Bayard Army Hospital, where his sputum was found to be positive for acid-fast bacilli. He was a patient in Fitzsimons Army Hospital from April to July 1924 and was subsequently admitted on five different occasions with the diagnosis of tuberculosis. He had an episode of severe dyspnea and hemoptysis in December 1948 and was admitted to this hospital on 11 January 1949 at which time his symptoms had increased to include dull aching bilateral chest pain and fatigability. Repeated sputum smears were negative for acid-fast bacilli and a roentgenogram revealed marked enlargement of the hilar glands. Bronchoscopy was recommended but the patient refused and left the hospital on 31 January.

On 15 February his cough markedly increased in severity and was productive of about 100 cc. of yellow sputum daily. He also coughed up clots of blood. The severe aching substernal pains, severe dypsnea, and extreme fatigability and anorexia had continued. Because of the increasing severity of the symptoms, the patient was again admitted to the hospital on 14 April.

Physical examination at that time revealed a chronically ill man who appeared much older than his stated age, with a temperature of 101.4°. The abnormal physical findings were limited to the chest. A roentgenogram taken on 29 April is shown in figure 5. Five negative sputum smears for acid-fast bacilli were obtained. His leukocyte count varied from 6,700 to 15,700. His erythrocyte count was 3.7 million with 76 percent hemoglobin. His sedimentation rate was 21 mm. per hour (Wintrobe). His vital capacity was 71 percent His ECG showed a right axis deviation. Roentgenograms of the chest showed a patchy diffusive infiltration involving the lower two-thirds of the right hemithorax. The patient was initially given penicillin therapy and was transferred to the tuberculosis service because of his history. A bronchoscopy was performed on 7 May. A mass was visualized in the right main bronchus below the orifice of the upper lobe of the right lung. The patient was seen by the tumor board on 13 May and was transferred to the tumor ward. It was noted that the left vocal

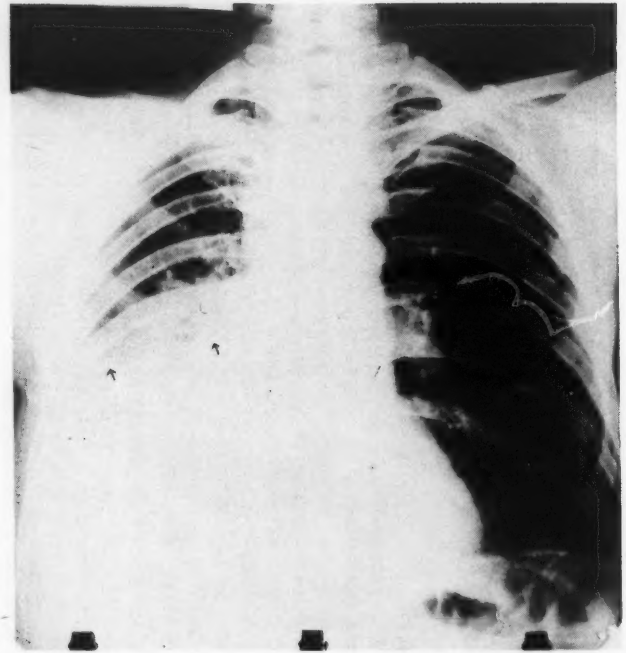

Figure 5 (Case 3). Roentgenogram taken on 29 April 1949 showing the extensive disease process associated with the right hilar mass.

Figure 6 (Case 3). The pathologic specimen showing the extensive involvement of the right lung with multiple carcinomatous nodules. The tuberculous lesion is not visualized.

cord was paralyzed and the patient had lost 17 pounds. The patient's course was steadily and rapidly downhill and was characterized by severe dypsnea and a hacking nonproductive cough. He died on 15 June.

The principal finding at autopsy was the tumor which was shown histologically to be undifferentiated, although the biopsy specimens had shown a few cells of the squamous type. The carcinoma extensively involved the right lung (fig. 6) and the mediastinal nodes with near occlusion of the superior vena cava and encroachment on the lumens of the pulmonary arteries. Metastatic lesions included abdominal lymph nodes, the esophagus, pancreas, and small bowel. Old healed chronic pulmonary tuberculosis was noted in the apexes of both lungs.

Case 4. A 50-year-old sergeant was admitted to this hospital on 31 August 1941. In January 1941 he noted a persistent nonproductive cough. He had smoked cigars prior to that time for an unknown period but following the onset of cough discontinued this habit. He had a roentgenographic examination of his chest in April about which no comment was made. He coughed up a small amount of dark clotted fluid on one occasion in June. Shortly following this he noted malaise, anorexia, and beginning loss of weight. He continued to work until 27 July at which time he was admitted to the Fort Snelling Army Hospital. A roentgenogram of the chest taken on admission (fig. 7) was reported as probable carcinoma of the upper lobe of the left lung with involvement of the hilum. Sputum examination at this time was negative to direct smear. The examination of the patient revealed an afebrile, emaciated man. A mass 3 cm. in diameter was noted under the left sternocleidomastoid muscle at its anterior end and was thought to be an enlarged thyroid. The patient had slight dullness to percussion associated with increase in the voice sounds and breath sounds over the upper anterior portion of the chest on the left side. The prostate was enlarged, firm, and nontender, the right lobe being slightly larger than the left.

A roentgenogram taken on 2 September showed a fan-shaped lesion extending from the left hilum outward to include the apex and the first and second interspaces anteriorly. This consisted of a coarse infiltration associated with thickening of the bronchovascular markings and with pleural thickening over the apex and the lateral portion of the upper lobe. The remainder of the left lung and the right lung appeared normal. Sputum examinations were again negative for tubercle bacilli. The patient was transferred to this hospital on 31 August.

The history and findings were essentially the same as those noted in the Fort Snelling Army Hospital. On 2 September a bronchoscopy which revealed a papillary endobronchial mass about 5 cm. from the carina in the left main bronchus in the region of its branch to the upper lobe was performed. On 22 September a left pneumonectomy

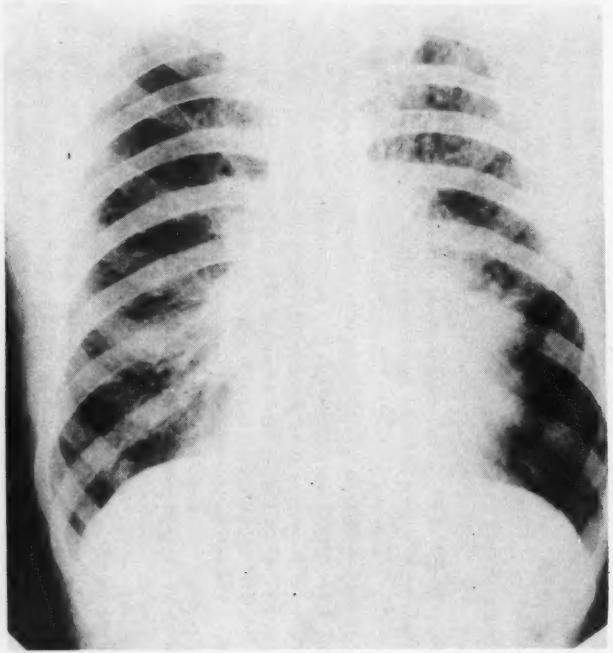

Figure 7 (Case 4). Roentgenogram taken on 27 July 1941 showing the left apical infiltration and cavitation, and the left hilar enlargement.

Figure 8. (Case 4). The pathologic specimen showing the papillary mass in the main bronchus and the scattered fibrocaseous tuberculous lesions.

was performed and the patient did well for about 1 week postoperatively. On about 1 October a pleural exudate began to form which was treated with frequent aspirations ending in closed drainage and a thoracotomy on 15 October. Following daily irrigation and drainage an open thoracotomy was performed on 27 October, following which the patient showed slight improvement. A wound dehiscence developed subsequent to the open thoracotomy, following which the patient gradually lost weight. He went gradually downhill and died on 26 December. Autopsy and surgical specimen findings included papillary bronchogenic carcinoma of the bronchus of the upper lobe on the left (fig. 8), mixed empyema on the left, and chronic active pulmonary tuberculosis, all lobes both lungs.

Case 5. A 54-year-old man was admitted to this hospital on 23 April 1949. He had had a slight chronic cough for 30 years associated with huskiness of the voice. This remained unchanged until about 2 months prior to admission at which time his cough increased and became productive of about 1½ cups of sputum per day, which was yellow and occasionally blood streaked. No foul odor was noted. The patient continued to have a feeling of congestion in his chest and generally felt ill. Two weeks prior to admission his temperature rose to 103° F. This was slightly reduced with 3 days of penicillin therapy, but returned to 103° F. prior to the discontinuance of the penicillin. The patient lost about 10 pounds in the 2 weeks prior to admission.

Physical examination on admission revealed an afebrile man who had apparently lost weight. The abnormal chest findings were limited to the right lung. Generalized arteriosclerosis and an enlarged prostate were also noted. His vital capacity was 3.7 liters or 82 percent of normal. A tuberculin skin test using PPD 1 was positive. Initial sputum cultures showed an abundant growth of Neisseria.

Roentgenograms of the chest taken on admission showed a fan-shaped density extending laterally and posteriorly in the region of the right hilar shadow. This was thought to represent segmental atelectasis of one of the basal bronchi of the lower lobe of the right lung. A bronchoscopy was performed on 27 April and a granular lesion which was raised, friable, bled easily, and obstructed one-half of the lumen of the right main bronchus was found immediately below the orifice of the right upper lobe. A biopsy specimen taken at this time showed a squamous cell carcinoma. The roentgenogram taken on 10 May is shown in figure 9. A right pneumonectomy was performed on 11 May. On the twelfth postoperative day the patient developed a bronchopleural fistula which closed after local therapy. On 4 August a first stage four-rib thoracoplasty which was followed 4 weeks later by resection of the sixth, seventh, eighth and ninth ribs, (the fifth rib having been removed at the time of pneumonectomy) was performed. The patient continued to have a small empyema cavity, and a draining sinus which

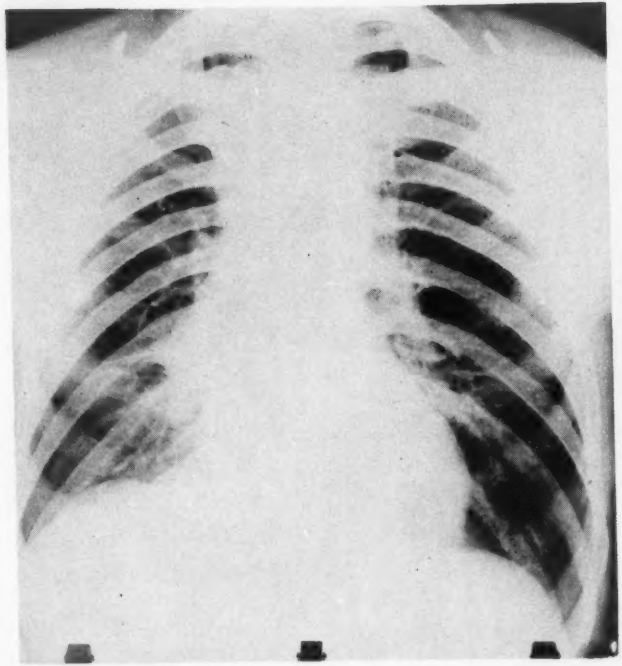

Figure 9 (Case 5). Roentgenogram taken on 10 May 1949 showing the enlargement of the inferior pole of the right hilum.

Figure 10 (Case 5). The pathologic specimen showing the extensive tumor mass.

had improved by November. In February 1950 the empyema cavity increased in size, the drainage increased in amount, and a bronchopleural-cutaneous fistula was established. Following this the course was progressively downhill and the patient died on 29 May.

The surgical specimen revealed bronchogenic carcinoma of the squamous cell type probably originating in the posterior segmental bronchus of the lower lobe of the right lung (fig. 10); bronchiectasis, cystic, suppurative throughout both lobes; and healed tuberculosis in the apex of the upper lobe of the right lung.

Case 6. A 55-year-old man was admitted to this hospital on 13 October 1950. He had had known pulmonary tuberculosis since May 1942 at which time he had had symptoms for 1 year. A roentgenogram at that time revealed tuberculosis in the upper lobes of both lungs and the sputum was positive. The patient was hospitalized for 9 months and was then clinically well until March 1950. He then developed increased symptoms, roentgenographic signs of cavitation, and blood-streaked sputum which was positive for acid-fast bacilli. Physical examination revealed a chronically ill man with temperature of 99.6° F. and a pulse of 110. Abnormal physical findings were limited to the chest. His sedimentation rate was 38. Sputum smears and cultures were positive for acid-fast bacilli. Roentgenograms taken on admission revealed linear and nodular parenchymal infiltrates in the upper lobe of the right lung most marked in the apex and first interspace anteriorly with evidence of cavitation in the region of the first interspace on the right. Productive inflammatory disease was also visualized in the midportion of the left lung extending outward from the hilar region. An ECG taken on 24 October revealed incomplete right bundle branch block. The vital capacity on 21 November was 4.2 liters or 96 percent of normal. A bronchoscopy on 6 November revealed an unsuspected squamous cell carcinoma in the anterior division of the bronchus to the lower lobe of the right lung. The roentgenogram taken on 2 December is shown in figure 11. The patient was seen by the Tumor Board and Chest Surgical Review Board and a right pneumonectomy was performed on 12 December. The postpneumonectomy thoracoplasty was not completed because of repeated episodes of hypotension associated with the induction of anesthesia. A right phrenemphraxis was performed on 29 January 1951. Four months later the patient was doing well. Examination of the surgical specimen revealed squamous cell carcinoma of the anterior division of the lower lobe and active tuberculosis in the apex of the right lung (fig. 12).

Case 7. A 51-year-old man was admitted to this hospital on 4 January 1950. He became concerned about his health in April 1949 because he had recently lost 40 pounds. The examination in a station hospital overseas in May 1949 including roentgenograms of the chest did not reveal any cause for his loss of weight. He returned to the United States and on a routine re-enlistment physical examination on 16

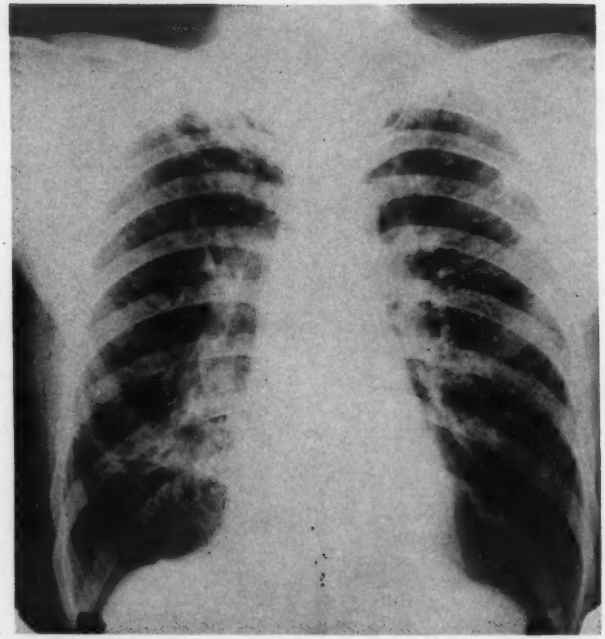

Figure 11 (Case 6). Roentgenogram taken on 2 December 1950 showing the infiltration and cavitation representing the tuberculous lesion in the apex of the right lung and first interspace anteriorly and the enlargement of the right hilum.

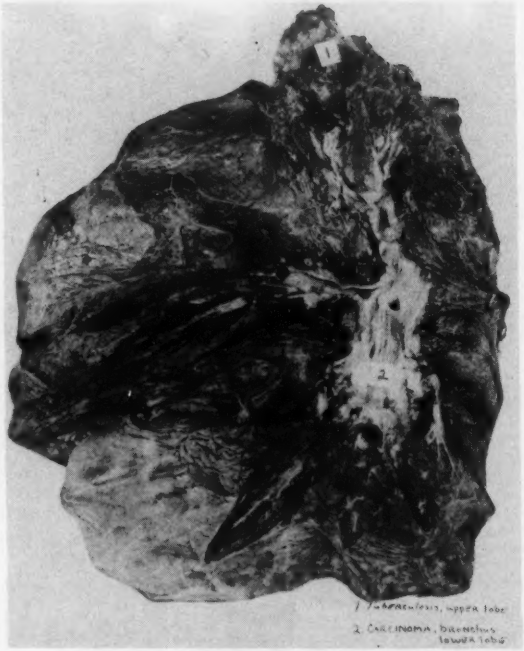

Figure 12 (Case 6). The pathologic specimen showing a tuberculous lesion in the apex and the carcinoma in the bronchus to the lower lobe of the right lung.

interspace anteriorly and the enlargement of the right hilum.

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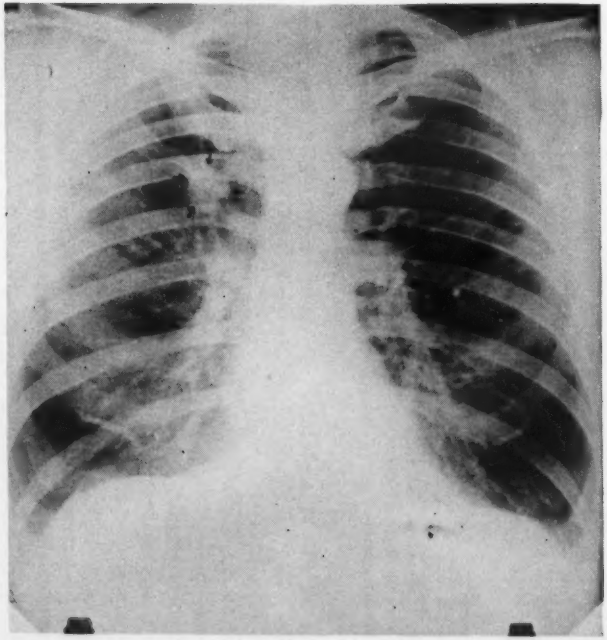

Figure 13 (Case 7). Roentgenogram taken on 4 January 1950 showing a nodular lesion under the second rib anteriorly which proved to be a carcinoma.

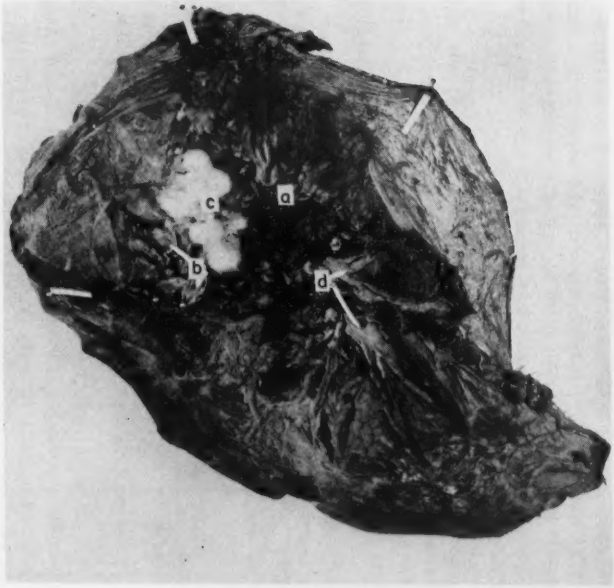

Figure 14 (Case 7). The pathologic specimen showing the carcinoma. The tuberculous lesion is not visualized. (a) Apical bronchus. (b) Posterolateral bronchus. (c) Tumor. (d) Anterolateral branch.

December a roentgenogram was taken which revealed a lesion in the right lung. The only symptoms referable to the respiratory system were a chronic cough of many years' duration productive of small amounts of mucoid material most easily raised in the early morning. His father died of carcinoma of the prostate.

Physical examination on admission revealed loss of weight and a slight decrease in the breath sounds associated with fine crepitant rales over the right hemithorax posteriorly. There was also a slightly red, tender area 3 mm. in diameter over the occiput.

TABLE 1. *Comparison of seven patients with tuberculosis and carcinoma of the lung*

	Patient						
	1	2	3	4	5	6	7
Age (years)	55	43	56	50	54	55	51
Tuberculosis diagnosed ante mortem	Yes	Yes	Yes	No	No	Yes	*
Known duration of tuberculosis (years)	28	18	28	Unknown	Unknown	8	Unknown
Tuberculosis active at death	Yes	No	No	Yes	No	Patient living**	Yes
Carcinoma diagnosed ante mortem	No	No	Yes	Yes	Yes	Yes	*
Both conditions diagnosed ante mortem	No	No	Yes	No	No	Yes	**

*Strongly suspected and used as clinical diagnosis in spite of absence of bacteriologic or pathologic proof.
**Tuberculosis active.

The sputum and gastric washings were repeatedly negative for acid-fast bacilli. A tuberculin skin test using PPD 2 was positive. Roentgenograms taken on admission revealed a rounded area of increased density with a well-circumscribed margin 3 cm. in diameter adjacent to the superior pole of the right hilus, which appeared, on the lateral projection, to lie in the posterior segment of the upper lobe of the right lung (fig. 13). Because of the linear densities extending from this region to the apex, the initial impression was probable pulmonary tuberculosis. A bronchogram showed obstruction of the apical bronchus and the possibility of bronchogenic carcinoma could not be excluded. Bronchoscopy on three different occasions revealed a normal tracheobronchial tree. A pneumonectomy was advised and was performed on 10 March 1950. The patient developed a bron-

chopleural fistula on the eighteenth postoperative day. Open drainage of the right hemithorax was performed on the thirtieth postoperative day but the patient did not do well. On 25 May the lesion on the scalp over the occiput was excised and was shown to be an anaplastic squamous cell carcinoma. On 10 June following continuous profuse drainage of the sinus tract, hard subcutaneous nodules were noted over the anterior aspect of the right arm and anterior aspect of the thoracic wall. These were diagnosed as metastatic tumor nodules similar to that excised from the scalp. The course was rapidly downhill and the patient died on 6 July.

Examination of the pathologic specimen obtained at operation revealed bronchogenic carcinoma of undifferentiated type in the apical bronchus to the upper lobe of the right lung (fig. 14). There was also active pulmonary tuberculosis in the apical segment. Metastases had occurred to the regional nodes, the right occiputal area of the scalp, and to the anterior aspect of the chest wall on the right.

A comparison of the cases reported is summarized in table 1.

DISCUSSION

These patients fall within the age group in which carcinoma of the lung is most commonly found. In the 4 patients whose tuberculosis was diagnosed bacteriologically ante mortem, the long duration of the disease is of interest. In 2 of these the chronicity of the disease and the knowledge of its existence may have delayed the diagnosis of carcinoma because of the suspicion of reactivation of the tuberculosis which in reality had not occurred. One patient whose carcinoma was discovered accidently was living and well 4 months after pneumonectomy.

Inasmuch as a clinical possibility exists for combined tuberculosis and cancer of the lung, one should not hesitate to suspect one disease even after the diagnosis of the other is made. The plea must be made to think of cancer in patients with pulmonary tuberculosis. The finding of acid-fast bacilli in a patient with known cancer is another problem. Suffice it to say that many saprophytic acid-fast bacilli have been found in carcinomatous tissue both clinically and at autopsy. The need for their differentiation in a laboratory must be kept in mind. Drymalski and Sweany *(15)* reported that in 10 of 15 patients with carcinoma showing acid-fast bacilli the latter were of secondary or minor importance.

One should be suspicious of inconsistencies in the symptomatology, clinical course, or findings, especially in tuberculous patients *(16, 17)*.

(15) Drymalski, G. W., and Sweany, H. C.: Significance of pulmonary tuberculosis when associated with bronchogenic carcinoma. Am. Rev. Tuberc. 58: 203-206, Aug. 1948.

(16) Gerstl, B.; Warring, F. C., Jr.; and Howlett, K. S., Jr.: Cancer and pulmonary tuberculosis; diagnostic problems in patients with cancer of lung in presence of pulmonary tuberculosis. Am. Rev. Tuberc. 54: 470-487, Dec. 1946.

(17) Shefts, L. M., and Hentel, W.: Bronchogenic carcinoma and pulmonary tuberculosis. Am. Rev. Tuberc. 61: 369-386, Feb. 1950.

The symptoms of tuberculosis and cancer of the lung are so similar as to be of no differential diagnostic significance, but the following should lead one to suspect cancer: (1) The absence of readily demonstrable bacilli on adequate repeated sputum examination in patients with florid exudative pulmonary disease; (2) roentgenographic progression of the disease, especially the development of atelectasis, with apparent clinical and laboratory improvement; (3) change in the character of a patient's cough, especially with a lack of sputum production; (4) change in the character of the sputum produced; and (5) development of wheezing with otherwise apparent clinical improvement. The importance of accurate and complete diagnosis cannot be underestimated in view of the greatly improved therapeutic (especially surgical) technics now available to us.

BOOK REVIEW

The Public Health Nurse and Her Patient, by *Ruth Gilbert,* Coordinator, Course for Mental Hygiene Consultants and Assistant Professor of Nursing Education, Teachers College, Columbia University. 348 pages. Published for The Commonwealth Fund by Harvard University Press, Cambridge, Mass., 1951. Price $3.75.

This text should be welcome to all nurses, and especially to the public health nurses who are familiar with the first edition of this book. The problems frequently encountered by the public health nurse are illustrated by numerous examples and by excerpts from case records. The need for, and the recognition of, emotional growth and maturity and its effect on the nurse's attitude, as well as that of the patient and the family, are clearly described. Every aspect of nurse-patient relationship, including the weak and strong points of public health agencies as influenced by the absence or presence of agency flexibility, appears to be brought out in this text. The recognition of the importance of individual needs and individual differences are not overlooked by the author. The nurse is reminded of the necessity to avoid attempting to mold the patient to the nurse's standards. The simplicity of language and the general style of writing make the book unusually readable. A selected bibliography is provided. In no way could the publisher's comment, "This book should be of value to public health nurses, to social workers, and to nurses in general" be interpreted as an overstatement. Every nurse who seeks workable information in preference to impractical theory would be glad to have this book in her reference library.

—*Lt. Comdr. G. E. Dvorak, NC, U. S. N.*

Cold Injuries With Emphasis on Frostbite

Preliminary Report *(1)*

Kenneth D. Orr, *Lieutenant Colonel, MC, U. S. A.*

David C. Fainer, *Captain, MC, A. U. S.*

ON 1 December 1950 at this hospital a Cold Injury Section was established for the study and treatment of patients with frostbite and other types of cold injury which were received during the Korean conflict. From 1 December 1950 to 1 April 1951, 4,216 patients were admitted to this hospital with a diagnosis of a cold injury. Most of them were ground troops with the so-called ground-type frostbite. Eighteen percent were transferred to hospitals in the Zone of the Interior between 1 December 1950 and 1 May 1951. At the close of the winter months summaries of the clinical records of 1880 patients who had incurred frostbite were available for analysis. About 86 percent of the cases involved the feet alone; 11 percent the hands and feet; 2.5 percent the hands alone; and 0.5 percent other sites.

Most of the cases occurred as the result of a tactical situation in which the soldier was immobilized for from 2 to 24 hours by enemy action, with the ambient temperature ranging from 20° to minus 30° F. Wet feet, inadequate protection and exhaustion were important in some, but not all cases. Severe climatic conditions and immobility for several hours appear to be the most important factors in the production of ground-type frostbite.

Much of our knowledge regarding the physiopathology of frostbite has come from experimental frostbite in laboratory animals. These lesions usually have been produced by immersion of the foot or ear of a rabbit into alcohol with a temperature of from minus 10° to minus 55° C. for a few minutes. The time sequence of frostbite in the rabbit foot or ear is shorter than in ground-type frostbite observed in human beings. Furthermore, there is frequently a sharp line of demarcation

(1) Work done at Osaka Army Hospital, Japan. This paper was presented 14 June to Military Medical Section, American Medical Association, Atlantic City, N. J.

of the frozen part of the rabbit when the injury is produced by immersion, whereas there is a gradation of the severity in human frostbite. The distal parts are more severely frostbitten than the proximal parts. Experimental frostbite is a "quick freeze," while human ground-type frostbite is a "slow freeze." Nevertheless, the events which occur in experimental frostbite are qualitatively, if not quantitatively, similar to human ground-type frostbite.

Freezing destroys some tissue *(2, 3)* but the tissue cell destruction is not caused by the freezing alone for a large part of the damage may be secondary to certain vascular changes *(4-8)*. As long as the tissue is frozen, there is no movement of blood. After rewarming, blood again flows freely into the frozen part. The freezing causes damage to the walls of the small blood vessels. The permeability of the capillaries is increased and fluid escapes from the vessel lumen. This process begins in less than 3 hours after rewarming in human beings. Vesicles and bullas appear within from 6 to 24 hours and contain fluid which is similar to the plasma. It becomes partially coagulated after a few days and on analysis of the fluid remaining, after from 5 to 8 days, from 3.7 to 5.2 grams of protein per 100 cc. is found with an albumin-globulin ratio of 3:1. The chlorides in the fluid range between 514 and 710 mg. per 100 cc.

Local hemoconcentration results from the leakage of fluid from the vessels of the frostbitten part. This phenomenon of local hemoconcentration is described variously as silting, sludging, and conglutination. This phenomenon results in stasis of blood flow which may be partly responsible for the subsequent necrosis of tissue. From 2 to 3 days after being severely frostbitten, patients will manifest cold toes as the result of decreased or absent blood flow. It has been impossible to produce warmth of cold parts by the use of sympathetic ganglion blocks or vasodilators.

Friedman et al. *(6)* described the conglutinated cells becoming organized into "agglutinative thrombi." Secondary or ascending throm-

(2) Lake, N. C.: Investigation into effects of cold upon body. Lancet 2: 557, Oct. 13, 1917.

(3) Pichotka, J.; Lewis, R. B.; and Freytag, E.: Sequence of increasing local cold injury. USAF School of Aviation Medicine. Project No. 21-23-006, Report No. 6, March 1951.

(4) Kreyberg, L.: Development of acute tissue damage due to cold. Physiol. Rev. 29: 156, 1949.

(5) Greene, R.: Immediate vascular changes in true frostbite. J. Path. & Bact. 55: 259-267, July 1943.

(6) Friedman, N. B.; Lange, K.; and Weiner, D.: Pathology of experimental frostbite. Am J. M. Sc. 213: 61-67, Jan. 1947.

(7) Quintanilla, R.; Krusen, F. H.; and Essex, H. E.: Studies on frostbite with special reference to treatment and effect on minute blood vessels. Am. J. Physiol. 149: 149-161, Apr. 1947.

(8) Fuhrman, F. A., and Crismon, J. M.: Studies on gangrene following cold injury; general course of events in rabbit feet and ears following untreated cold injury. J. Clin. Investigation 26: 236-244, Mar. 1947.

bosis may occur to produce a further loss of adjacent tissue. Specimens removed at this hospital and elsewhere weeks or months after freezing showed adherent thrombi of all vessels.

The simplest classification divides frostbite into 4 degrees of severity. These divisions cannot be made in the first few hours after rewarming because most lesions have a similar appearance at that time. The differentiation can seldom be made until 24 or more hours have elapsed. All degrees of frostbite may be present in a single extremity. The most distal part of the extremity is usually the most severely damaged.

First degree frostbite (table 1) is characterized by numbness, swelling, and erythema of the involved part. In some cases desquamation may occur later. Many men with first degree frostbite were not evacuated.

TABLE 1. *Characteristics and incidence of each degree of frostbite in 1,880 patients*

Degree	Characteristics	Incidence (percent)
First	Numbness, swelling and erythema. No vesicles. Superficial desquamation in some cases.	16.7
Second	Partial skin thickness vesiculation.	33.6
Third	Involvement of entire thickness of skin and varying depths of subcutaneous tissue. Vesiculation may or may not be present.	43.6
Fourth	Involvement resulting in loss of the part.	6.1

Second degree frostbite (table 1) produces vesiculation of the skin. This involves only partial skin thickness. When the vesicle is shed, the underlying area is epithelized and ulceration into subcutaneous tissue is absent. The most common sites for this degree of injury have been the distomedial portion of the great toes, the lateral aspect of the fifth toes, and the dorsum of fingers.

Third degree frostbite (table 1) involves the entire thickness of skin and varying depths of subcutaneous tissue. The most common sites for this degree of injury are the great toes, second toes, heels, and tips of the fingers. A vesicle may or may not develop at the site of injury. If a vesicle does form, its wall is much thicker than that found in second degree frostbite. In third degree frostbite, the lesion may be a small area of full-skin-thickness damage at the center of a vesicle on a toe, or it may involve the skin and subcutaneous tissue of an entire digit.

In *fourth degree frostbite* (table 1) the injury extends through the entire thickness of the part, including bone. Fourth degree frostbite results in the loss of an extremity or part of it. The most common sites for this injury have been digits or the distal third of the foot. Thin-walled bullas are commonly present over the dorsum and sole of the foot at the proximal periphery of the severely injured part. The position of the bulla is of prognostic significance, usually indicating severe damage to tissue distal to it. Few or no vesicles are seen on the distal portions of the toes or parts which have incurred fourth degree frostbite. Edema of the entire part occurs, developing within 3 hours after thawing. Parts which become cold and *remain* cold will be lost despite any therapeutic measure.

CASE REPORTS

Case 1. A soldier was frostbitten on the night of 13 January 1951. On 14 January a vesicle had formed on the left great toe. By the twelfth day after injury, the vesicle had completely collapsed and dried, forming a hard, brown-black eschar. Twenty-four days after injury, the eschar came off revealing a thin, violet, intact skin. This lesion was second degree frostbite and was differentiated from third degree frostbite by the absence of an ulcer extending into subcutaneous tissue after the eschar was removed.

Case 2. A soldier was frostbitten on the night of 13 January 1951. On 14 January vesicles were present on the left first and second toes. Three days after injury slight edema was present over the dorsum of the left foot. Large vesicles were present on the left first and second toes. Erythema proximal to the vesicles was present. On the twelfth day the vesicles had enlarged and were tense. Erythema and tenderness were still present proximal to the vesicles. The vesicles became softer and developed a deep purple color. Seventeen days after injury the second left toenail was débrided. By the thirty-third day the vesicle of the left great toe had dried into a hard, black eschar. Because of purulent drainage the eschar on the left great toe was débrided on the forty-second day, exposing a granulating area. This granulating area re-epithelized slowly and resulted in scarring and induration of the involved toes. This was a third degree frostbite.

Case 3. A soldier became frostbitten on the night of 3 January 1951. On 4 January, following removal of his boots, his feet swelled to such an extent that he was unable to replace the boots. Six days after injury he complained of shooting pain in the feet. There was marked pitting edema of the feet and ankles (fig. 1). The distal two-thirds of the feet were cool to touch although the pedal pulses were strong. Ten days after injury the edema had subsided. Fourteen days after injury extensive wet necrosis of the superficial tissue was present at the base of the third and fourth toes on the dorsum of the left foot. By the fortieth day after injury (fig. 2) many toes had become mummified.

Figure 1 (case 3). Showing fourth degree frostbite of the toes of both feet 6 days after injury. Figure 2 (case 3). Showing mummification of the toes and extensive wet necrosis 40 days after injury. Tendons are exposed on the right. Figure 3 (case 3). Showing clean granulation tissue following amputation. Skin grafts were applied later.

Large wet necrotic areas extended across the dorsum of both feet. A putrefactive odor was present. Tendons leading to the right second, third, and fourth toes were exposed. The patient's daily temperature ranged from 98.6° to 99.4° F. Slightly tender, moderately enlarged lymph nodes were present in each femoral triangle. Forty-three days after injury all toes except the left fourth and fifth were removed. Eight days after operation (50 days after injury) (fig. 3) healthy granulation tissue was present and no odor of putrefaction remained. Skin grafts were necessary to complete the treatment after which the patient was able to walk again.

DISCUSSION

All fourth degree frostbite does not have a course similar to that of case 3. Wet gangrene may not develop. The parts may merely dry and mummify. A definite line of demarcation exists. These patients received general symptomatic and local care. No therapeutic agent or procedure alleged to influence the course of frostbite was used and they represent examples of a control group.

The treatment of frostbite, as observed in the Korean conflict, should be divided into three overlapping phases. The *first phase* deals with the management of the patient in the forward areas of the combat zone. Any constrictive clothing should be removed from the site of injury. If the lesion involves the feet, the patient should be carried on a litter. Rewarming of the lesion remains a problem; all possible methods are advocated in the literature. Recent experimental work *(9-12)* has indicated that quick rewarming in rapidly frozen animal parts lessens the eventual damage produced. Whether this can be applied to the ground-type, slow freeze is unknown. Only 2 percent of patients with frostbite in Korea were seen at battalion aid stations before edema and vesicles had appeared. Because of this, and since proper facilities were not available, rapid rewarming was not used.

Local care of the lesion in the forward area is directed toward the protection of intact vesicles and bullas. As a rule, those patients in whom the vesicles or bullas were completely denuded or drained arrived in the hospital with infected lesions. Protection of the lesion by wrapping loosely in blankets or a loose dry dressing, being sure that body warmth was maintained, is advised. Those patients who had a vaseline

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(9) Arev, T. Y.: Question of slow or rapid warming of frozen extremities. Vestnik Khir. 57: 527-535, May 1939.

(10) Fuhrman, F. A., and Crismon, J. M.: Studies on gangrene following cold injury; treatment of cold injury by means of immediate rapid warming. J. Clin. Investigation 26: 476-485, May 1947.

(11) Lempke, R. E., and Shumacker, H. B., Jr.: Studies in experimental frostbite; evaluation of several methods for early treatment. Yale J. Biol. & Med. 21: 231-334, Mar. 1949.

(12) Pichotka, J., and Lewis, R. B.: Effect of rapid and prolonged rewarming on local cold injury. U. S. Armed Forces M. J. 2: 1293-1310, Sept. 1951.

pressure dressing applied in the forward area hospitals showed a greater amount of infection and lost an equal or greater amount of tissue.

The *second phase* of treatment deals with the patient in a hospital. Strict bed rest is necessary until the vesicles or bullas have dried. The duration of bed rest depends on the severity of the lesion. Edema usually is present in severe third and fourth degree lesions, particularly in those of the lower extremities. At this hospital it was found that the edema subsided more rapidly when the foot of the bed was elevated 5 inches.

A ward temperature between 70° and 78° F. was found to be the most satisfactory. Higher and lower ward temperatures increased the degree of pain in the injured part. Sheets and blankets at the foot of the bed were folded back 18 inches so that frostbitten feet were exposed at all times. Under these conditions pain was not a serious problem and narcotics were seldom required.

Various agents and procedures which affect the peripheral circulation have been advocated in the treatment of frostbite. Vasodilator agents and sympathetic ganglion blocks with procaine or with absolute alcohol were begun from 2 to 15 days after injury. The course of the injury was not favorably influenced when the results were compared with the control group.

Lange et al. *(13)* found that the degree of damage was greatly reduced when heparin was administered to experimentally frostbitten animals, although others *(7, 14, 15)* have been unable to confirm this observation and still others have had only partial success *(16)*. Heparin was given intravenously in amounts sufficient to maintain the clotting time (Lee-White) above 20 minutes, beginning from 36 hours to 10 days after injury. The results seem favorable when compared with the control group. Wet gangrene did not occur as it did in some patients in the control group and in some in whom vasodilatation was produced. The lesions dried and mummified and surgical therapy was not necessary until a definite line of demarcation appeared. In a few patients with apparent fourth degree frostbite, in whom anticoagulant therapy was started less than 3 days after injury, the degree of damage was less than predicted.

An attempt was made to reduce surface bacteria by daily cleansing with a mild, colorless antiseptic solution (1:1000 zephiran chloride).

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(13) Lange, K.; Weiner, D.; and Boyd, L. J.: Frostbite; physiology, pathology and therapy. New England J. Med. 237: 383-389, Sept. 11, 1947.

(14) Pichotka, J., and Lewis, R. B.: Use of heparin in treatment of experimental frostbite. Proc. Soc. Exper. Biol. & Med. 72: 130-136, Oct. 1949.

(15) Fuhrman, F. A., and Crismon, J. M.: Studies on gangrene following cold injury; effect of rutin and other chemical agents on course of experimental frostbite in rabbits. J. Clin. Investigation 27: 364-371, May (pt. 1) 1948.

(16) Finneran, J. C., and Shumacker, H. B., Jr.: Studies in experimental frostbite; further evaluation of early treatment. Surg., Gynec. & Obst. 90: 430-438, Apr. 1950.

Vesicles were left intact until they ruptured spontaneously, at which time they were débrided.

The *third phase* of treatment deals with local foot care and the prevention of infection. It is similar to the treatment of any wound or traumatized part, regardless of cause. This requires débridement of loose, necrotic tissue, cleansing of suppurative parts, and the administration of antibiotics as indicated.

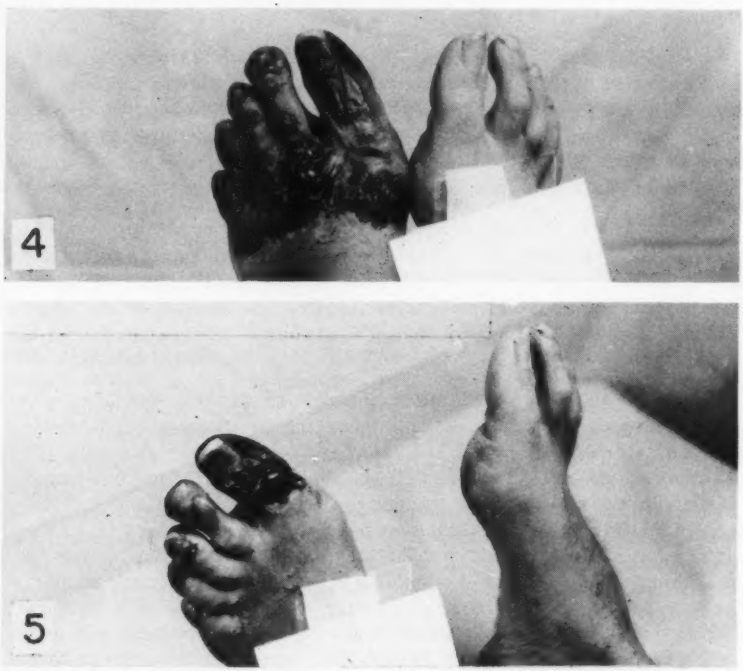

Figure 4. Showing an apparent line of demarcation through the distal third of the foot 15 days after injury. Figure 5. Same patient as shown in figure 4. Tissue is normal except for the great toe, 20 days after injury, and following superficial débridement.

At this hospital, penicillin was given to all patients with frostbite severe enough to produce vesicles. Other antibiotics were given when organisms not sensitive to penicillin were present. Superficial débridement was performed frequently. Cleansing was accomplished by soaks in a solution consisting of equal parts of 1:1000 aqueous zephiran chloride and 3 percent hydrogen peroxide, or in normal saline solution followed by wet zephiran-peroxide dressings for from 6 to 8 hours. Frostbitten parts were left exposed to the air when soaks or wet dressings were not being used.

Emergency amputations are seldom indicated in frostbite, except in patients showing extensive putrefactive gangrene associated with lymphadenopathy and signs of general sepsis. It is desirable to allow a definite line of demarcation to appear in order to preserve the greatest possible amount of tissue and attain maximum function. An apparent line of demarcation may be seen early, but débridement may reveal that the proximal part of the apparently necrotic tissue is superficial, with normal tissue below. This is illustrated in figures 4 and 5. Tissue distal to a definite line of demarcation will be dry, black, and shriveled or mummified.

SUMMARY

Most patients with cold injury incurred in the Korean conflict during the winter of 1950-51 were ground-type frostbite. In 86 percent of these patients the feet, in 11 percent the hands and feet, in 2.5 percent the hands alone, and in 0.5 percent other sites were involved. The treatment of ground-type frostbite can be divided into 3 overlapping phases. Future experimental work will have to be modified more closely to simulate ground-type frostbite occurring in human beings before final conclusion regarding treatment may be made.

BOOK REVIEW

Social Aspects of Illness, by *Carol H. Cooley,* Director of Social Service, The Presbyterian Hospital, Chicago; with a foreword by *Edna S. Newman,* M. A., R. N. 305 pages. W. B. Saunders Co., Philadelphia, Pa., publishers, 1951. Price $3.25.

The nurse must be able to recognize such social factors in illness, as housing, unemployment, rehabilitation, and community resources. She must appreciate their significance and know how the patient can obtain help. Special problems presented by various age and diagnostic groups are also discussed in this book. Team relationships are stressed through the use of practical, rational explanations of the role of the nurse in collaboration with the social worker. This book should be a valuable aid to the student nurse in making the application to situations found in the hospital, out-patient department, and the community.

—*Lt. R. M. Hutchinson, NC, U. S. N.*

A Textbook of Medical Conditions for Physiotherapists, by *Joan E. Cash,* B. A., M. C. S. P. (Teachers' Certificate), with a foreword by *Frank D. Howitt,* C. V. O., M. A., M. D., F. R. C. P. 350 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1951.

This book is a supplementary guide to a physical therapy text. It should assist the student as well as the graduate physical therapist

in the principles of treatment by physical measures. The objectives are clearly stated and well-chosen references are given. Part one describes the pathologic changes of degeneration, disturbances of circulation, atrophy and hypertrophy, and hypoplasia and hyperplasia. The remaining sections of the book deal with various disease entities. Each chapter includes detailed information concerning the condition discussed followed by an outline of treatment.

—*Lt. M. J. Topercer, NC, U. S. N.*

Collected Papers of the Mayo Clinic and the Mayo Foundation, edited by *Richard M. Hewitt*, B. A., M. A., M. D.; *A. B. Nevling*, M. D.; *John R. Miner*, B. A., Sc. D.; *James R. Eckman*, A. B., M. A., Ph. D.; *M. Katharine Smith*, B. A.; *Carl M. Gambill*, A. B., M. D., M. P. H.; and *Florence Schmidt*, B. S. E. Vol. XLII, 1950. 812 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1951.

These papers offer a compact reference volume on a variety of clinical subjects to a busy practioner or to a military physician far removed from a medical library. The volume contains 211 articles republished in full, abridged, or abstract form, many of which were originally published in state medical journals of limited circulation. These are subdivided under 13 major subject headings as follows: Cortisone and ACTH; Ductless Glands; Alimentary Tract; Blood and Circulatory Organs; Skin and Syphilis; Head, Trunk, and Extremities; Chest; Brain, Spinal Cord, and Nerves; Radiology; Physical Medicine; Anesthesia, Gas, and Intravenous Therapy; and Miscellaneous. References to 523 other publications from the Mayo Clinic during 1950 are also subdivided according to these topics.

Beginning with the Nobel prize lectures of Kendall and Hench on cortisone and ACTH, a series of articles summarize the clinical usage and physiologic effects of these compounds. Hyperthyroidism, hyperparathyroidism, and tumors of the thymus are discussed in summary form with comment on advances in therapy. Articles on esophageal varices, peptic ulcer and malignancy, pancreatitis, chronic ulcerative colitis, and amebiasis are included and the follow-up studies of the results of vagotomy in the treatment of peptic ulcer will be of interest to many. Highlighting the section on circulation are particularly logical discussions of the status of digitoxin versus digitalis, of vascular hyper-reactivity in relation to hypertension, and excellent summaries on the treatment of heart disease and of peripheral vascular diseases and injuries. Many other brief discussions of medical, surgical, and orthopedic problems of clinical interest will be found and the subject matter is too variegated to attempt adequate review. Most readers, however, should find the sections on radiology, physical medicine, and anesthesia valuable and interesting, if they, like this reviewer, have not regularly followed progress in these fields. Of particular interest are the papers on electronically controlled anesthesia and on regional block anesthesia.—*Commander J. R. Seal, MC, U. S. N.*

A New Local Treatment for Burns

Paul E. Spangler, *Captain, MC, U. S. N. (1)*

THE multiplicity of the local treatments advocated for burns is proof that the ideal treatment has yet to be found. At present some form of pressure dressing is preferred by most surgeons. Indeed, this method has given very acceptable results. We are not concerned with the systemic treatment of burns in this discussion except as the local treatment may aid in controlling the physiologic disturbances caused by severe thermal injury. Although the local treatment is secondary in importance to the control of the electrolyte and water balance and the prevention of infection and anemia, it is desirable to continue our search for improvements in treating the local thermal injury.

Pressure dressings have definite limitations. They are bulky and because they require much storage space, adequate materials are not always available. Periodic resterilization of these stored materials is burdensome. They are not easy to apply, nor are they well adapted to all parts of the body. Their bulkiness often prevents the patients from being able to help themselves and thus increases the burden of nursing care. Pressure dressings do not produce enough pressure to inhibit the loss of body fluids from the injured area or into the adjacent tissues and, in spite of aid from the antibiotics, they do not successfully prevent secondary infection of the burned areas. These limitations are most keenly felt when a large number of burn casualties must be treated at one time.

The open treatment of burns is receiving renewed interest. This method also gives good results but it does not appear to be adaptable to many burned patients. The dry eschar is often difficult to obtain and, in the meantime, much tissue fluid is lost and much swelling occurs. Patients require a great deal of nursing care during this drying-out period. The eschar is apt to crack and then the weeping again becomes a problem. Furthermore transportation of patients being treated by the open-air method presents nearly insurmountable difficulties.

(1) U. S. Naval Hospital, Portsmouth, Va.

The paraffin and other wax treatments so popular in the past use the same principle as is involved in the method under discussion, i. e., an effective occlusive dressing which keeps contaminants out and vital fluids and tissue components in, where they can aid the healing process. The objection to this method of treatment is the technical difficulty in its application and the necessity for frequent removal and reapplication. It, too, is apt to crack and separate and thus permit weeping. Frequent redressing exposes the wound to infection. The method about to be described overcomes most of these objections and is believed to represent a real improvement in the treatment of burns.

In March 1951 this hospital, among others, was designated to make a field trial of a new local treatment for burns. This paper constitutes the report of 22 patients treated by this method. Our experience to date, although limited, has been encouraging. Those of us who have used it believe that this treatment is the best local treatment for burns and that it offers these advantages:

1. It is quickly and easily applied.

2. Its application can be readily mastered by nonprofessional people.

3. It requires about one fifth the storage space which would be required for a comparable pressure dressing.

4. Amelioration of pain is marked and rapid.

5. The loss of body fluids from the wound is eliminated and tissue edema is minimized.

6. The dressing forms an impervious semiflexible coating which adheres firmly to living as well as devitalized cells, thus preventing further contamination and minimizing infection.

7. It applies an inherent local pressure, thus further minimizing edema.

8. Although the dressing is stiff enough to provide some splinting of the injured parts, it has enough flexibility because of its small bulk to allow the patient to care for himself.

9. The patient's own proteolytic enzymes and other phagocytic elements are retained at the site of injury, where they usually accomplish a prompt and complete débridement without infection so that skin grafting of the third degree burned areas is usually possible at the time of the first dressing, from 10 to 14 days after injury. In severe burns with much tissue necrosis this accumulation of phagocytic and lytic agents under the dressing often gives the appearance of infection, but smear and culture of this material usually fails to reveal organisms, and the facility with which split thickness grafts can be applied to these areas after thorough cleansing with G-11 soap proves that gross infection is not present.

10. It is suitable for any part of the body.

11. It is well adapted for the mass treatment of burns.

12. The prevention of further contamination and the patient's self-reliability make it ideal where transportation is required after the primary treatment.

The principle of this new method is not new, but the method and application are. It was developed over a period of 10 years by Dr. Raymond M. Curtis and his associates. Two materials are used. The first is a gel composed of partially hydrolized casein, sodium lactate, and sodium lauryl sulfate. This mixture after sterilization is a neutral gel about the consistency of molasses. It has been stored for several years with no deterioration. Freezing does not affect it. The second part of the dressing is a four-ply, coarse-meshed gauze, impregnated with zinc acetate *(2)*

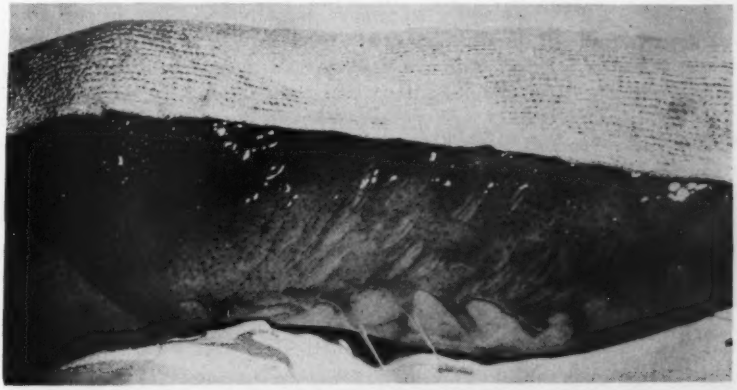

Figure 1. Initial dressing of third degree burn of leg. (Photograph by courtesy of Curtis, Brewer, and Rose.)

Without débridement other than evacuating large blisters and the aseptic removal of loose necrotic skin, the gel is spread over the entire burned area with a wooden spatula under sterile precautions. The gel is applied evenly, about 1/16-inch thick. The impregnated gauze is then laid over the gel and pressed down so the gel thoroughly penetrates the meshes of the gauze (fig. 1). The gauze is applied lengthwise and not circularly on the extremities. It is tailored to fit the burned areas smoothly. (An alternate method is to spread the gel on the impregnated gauze and then lay the gauze "butter side down" over the burn.) The dressing is then secured with an elastic bandage, not with the idea of exerting pressure but to assure firm apposition of the dressing while it is setting. On the face and head, the elastic

(2) These materials are packaged together as zinax.

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bandage is omitted, but greater care must be exerted to see that the gel impregnates the meshes of the gauze completely. The gel will set without the zinc acetate gauze, and is occasionally so used on the face and neck, but setting is accelerated when the gauze is used. The fingers are bandaged individually when burned, to allow some activity and add to the patient's self-reliability.

Following the application of the dressing, the gel sets in a few minutes. Within a few hours the burn is covered with an adherent, impervious, protective membrane which will allow no molecule larger than water to pass through. This membrane produces pressure over the burned area by fixing each cell to the position it occupied when the gel set. The body's own phagocytic and reparative agents are retained at the site of injury, where they are needed, and as a result first and second degree burns are practically always healed when the dressing is first removed in from 10 to 14 days, and the areas of third degree burn are usually self-débrided and ready for grafting at this time (fig. 2). It is customary to remove the first dressing in the operating room, with all preparations made for skin grafting. The devitalized tissue usually lifts off with the dressing. Soaking in warm water will soften the dressing and facilitate the removal if it is too adherent. The third degree areas appear as clean subcutaneous fat, to which split grafts of from 0.0012 to 0.0014-inch readily adhere and grow (fig. 3). This experience is the rule where the gel can be applied within the first few hours after injury. If a pressure dressing with or without vaseline has been applied, this is removed and the vaseline cleaned off with dry gauze or ether before the gel is applied. When there has been delay in the application of the gel, increased opportunity for contamination exists, and in some of these patients we have observed mild infection which has delayed grafting for a few days. In

Figure 2. Same burn 18 days after injury, following removal of dressing in operating room, and showing burn tissue completely lysed exposing subcutaneous fat. The complete area was covered with dermatome skin grafts on the eighteenth day. (Photograph by courtesy of Curtis, Brewer, and Rose.)

Figure 3. Final result 6 months after skin grafting of the same burn. (Photograph by courtesy of Curtis, Brewer, and Rose.

the patients dressed promptly after injury we have observed no infection.

The experience of others using this treatment parallels our own. Curtis et al. (3), the originators, in presenting this treatment to the 1951 meeting of the Americal Medical Association, reported its use in 115 cases. They state: "The results obtained in burns with this treatment for ambulatory as well as hospitalized patients have been most gratifying." They called attention to the work of Glenn et al. (4), who demonstrated the part played by tissue edema in the production of fibrosis associated with burns, and also the fact that this edema and fibrosis could be prevented by encasing burned extremities in plaster casts. They (Curtis et al.) stated: "The ability of the protein film to adhere to the injured surface provides a type of immobilization and tissue support which cannot be accomplished by the usual pressure dressing. Clinically and experimentally, we have found that this dressing diminishes superficial loss of fluid as well as the loss of protein into the burned area. We have been repeatedly impressed in our clinical cases with the ability of this dressing to prevent blistering in the superficial burns and edema of the injured parts in the extensive ones."

For a comparison of the open treatment with the use of a zinax dressing in a rabbit see figure 4. Both the animal's forelegs were exposed to 100° C. for 30 seconds. One foreleg was immediately dressed with a zinax burn dressing. When the dressing was removed 5 days later the leg showed no swelling and partial débridement had occurred. In the other foreleg, which had been exposed to the air,

(3) Curtis, R. M.; Brewer, J. H.; and Rose, I. W., Jr.: New technique for local treatment of burns. J. A. M. A. 147: 741-743, Oct. 20, 1951.

(4) Glenn, W. W. L.; Gilbert, H. H.; and Drinker, C. K.: Treatment of burns by the closed-plaster method, with certain physiological considerations implicit in success of this technique. J. Clin. Investigation 22: 609-625, July 1943.

Figure 4. The extremity on the left was immediately dressed with zinax burn dressing which extended 1 inch above the burn. The extremity on the right received no dressing (open treatment). This photograph was taken 5 days after injury. (Photograph by courtesy of Curtis, Brewer, and Rose.)

swelling extended well above the upper margin of the burn and separation of the necrotic skin had not yet started.

Fleischer *(5)* has treated 447 burns by this method; 359 were thermal, 67 were friction, and 21 were chemical burns. About 33 percent were first degree and the rest were second and third degree burns. He reported a decrease in the number of dressings required, better results with less scarring, the patients were comfortable during treatment, and, most important of all, none lost time from work. Fleischer continued with zinax dressings until the burns healed; even those which were third degree were not grafted. He reported better results with less scarring and stated: "We believe this treatment has worked as well with minor as with major burns, and it represents a better method than those formerly available for the treatment of the industrial burn."

(5) Fleischer, W. E.: Personal communication.

Firor *(6)*, who has had wide experience with all recommended methods of treatment, in discussing Curtis' presentation of this subject said: "During the past 30 years we have come a long way in understanding the altered physiology of the burned patient. As a consequence, our treatment of the burned patient has improved enormously, but our treatment of the burned area has not shown similar improvement. * * * We have made very little progress until the work which has just been presented. * * * It is my firm conviction that the method described by Curtis and Brewer today is unquestionably the best that has been developed. Having watched the evaluation of their method, and having used it at the Maryland General Hospital, I can say that it is far superior to all others. I wish to take this opportunity to confirm the claims made by the authors concerning its efficacy, and to congratulate them on their persistence in developing it."

We have treated 22 consecutive burns by this method. The more severe and complicated cases are reported in detail. The rest are grouped together, as none had third degree burned areas and all were healed without scarring when the first dressings were removed from 6 to 12 days after injury.

CASE REPORTS

Case 1. An 8-month-old boy received extensive second and third degree burns involving 50 percent of his body surface as well as burns of the mouth and nasopharynx. Zinax was applied at once and vigorous supportive measures were instituted, including 10 mg. of ACTH q. i. d. The child was critically ill and in spite of what appeared to be an adequate electrolyte and fluid balance he died with pulmonary edema 1 week after injury: Therefore the value of zinax in this case could not be determined but the dressing was still firmly adherent at the time of death. There was no evidence of infection of the burned areas. There had been no fluid loss of any consequence from these burns, because this was effectively prevented by the dressing. Autodébridement of the third degree areas was not complete at the time of death.

Case 2. A 29-year-old woman received second and third degree burns of the right hand, arm, and axilla, estimated to involve about 10 percent of the body surface. A preliminary dressing with vaseline gauze had been applied. Zinax was applied about 90 min. after the injury, and the dressing was removed 15 days later. At this time the second degree areas were healed. There were some areas of third degree burn on the arm and the back of the hand. There was an accumulation of cloudy fluid in the arm area which, however, failed to show any growth on culture. After 4 days of wet dressings, split grafts were applied, and these all healed by primary intention. Although the impression was that these third degree areas were infected, it is quite probable that the secretion observed represented the accumulated lytic material under the dressing and not true infection.

(6) Firor, W. M.: Personal communication.

Case 3. A 5-year-old child received first, second, and third degree burns of the right palm, hip, and thigh, involving about 5 percent of the body surface. Zinax was applied 45 min. after the burn and was removed 14 days later. At that time the first and second degree areas were completely healed. On the palm of the hand there was a thick-walled blister which contained some yellow fluid. There was an area of about 14 sq. cm. on the palm of the hand for which grafting was planned, but this was deferred because of mumps and when the mumps was cured this area had filled in from the periphery.

Case 4. A 21-year-old man received second and third degree burns of the right lower extremity, involving about 10 percent of the body area. He was admitted to the hospital 9 days after the injury and zinax was applied. The dressings were removed 9 days later. The first and second degree areas were entirely healed. The third degree area was not ready for grafting, but after the application of saline dressings for a few days a split graft was applied. This resulted in 50 percent take and a second grafting was necessary to heal the wound. Zinax was applied late in this case and the results were not quite as satisfactory as those in which it was applied immediately after the burn.

Case 5. A 3-year-old child received burns of the neck, shoulder, and face involving 6 percent of the body surface. Zinax was applied 30 min. after the burn. The dressing was removed 2 weeks after the injury and all the first and second degree areas were completely healed. There were 2 small areas of about 2 by 2 cm. which were grafted immediately with a 0.0014-inch split graft. Healing occurred promptly following this treatment.

Case 6. A 34-year-old man received second and third degree burns of the entire surface of both forearms and hands, involving about 15 percent of the body surface. He was treated with vaseline gauze and pressure dressings, ACTH, and penicillin for about a month prior to the application of zinax. Zinax dressing was then applied to the area which had not healed and from which the slough had not separated. Ten days after the application of zinax the dressing was removed and the third degree area which had been covered with a purulent crust was clean and there was an area of about 9 by 4 cm. which was clean and ready for grafting. Application of a 0.0012-inch split graft resulted in 95 percent take.

Case 7. A 22-year-old man received second and third degree burns of the right leg and ankle. He was admitted to the hospital 4 days after injury. He had had a pressure dressing with vaseline gauze. This dressing was removed and zinax was applied. Fourteen days later the dressings were removed. The first and second degree burned areas were healed and there was a third degree burn of 5 by 2 cm. on the lateral surface of the ankle. At the time the dressing was removed,

this area was clean and a split graft was applied. Healing occurred promptly with minimal scarring.

Case 8. An 11-year-old boy received burns of the hands and arms covering about 5 percent of his body surface. Vaseline pressure dressings were applied. These were removed 35 hours later and a zinax dressing was applied. This was removed 11 days later. The first and second degree burns were entirely healed. There were three third degree burns measuring 3 by 3 cm. 2 by 3 cm., and 2 by 2 cm. A few vesicles which had not been ruptured prior to the application of the zinax remained when the dressing was removed. These contained a cloudy fluid, but were not grossly infected. It is probable that the vaseline had been inadequately removed prior to the application of zinax, otherwise this dead skin would have been removed with the dressing. These small areas healed rapidly without grafting.

Case 9. A 20-year-old man received burns of the face, both forearms and wrists, and the anterior surface of both legs, covering 20 percent of the body surface. He was treated immediately with vaseline gauze and pressure dressings. Two days later these were removed and zinax applied. This was removed 12 days later. The first and second degree burns were completely healed. There was an area of third degree burn about 2 sq. cm. on the dorsum of the left hand which healed rapidly with nitrofurazone ointment dressings. Grafting was not necessary.

Case 10. A 27-year-old woman received first and second degree burns of the face and arm involving about 15 percent of the body surface. She was treated immediately with face cream. Zinax was applied 3 hours after injury and 12 days later it was removed. Epithelization was complete except for a few moist areas of about 1 by 2 cm. on the face. These were deep second degree burns and were completely healed 9 days later, with minimal scarring.

Case 11. A 22-year-old man received a burn involving about 10 percent of the body surface. Vaseline gauze pressure dressings were applied. Twenty-four hours later zinax was applied. This dressing was removed 12 days later. The burns had completely healed, with minimal scarring, except for a third degree burn measuring 5 by 5 mm. on the dorsum of the right hand. This was clean and 3 days later had filled in from the periphery.

Cases 12 to 22. The remaining patients received relatively superficial burns involving from 5 to 20 percent of the body surface. Zinax was applied as the primary dressings and removed in from 6 to 14 days, and in all cases all burned areas were completely healed with minimal scarring. No infection was found under the zinax dressing in any of these patients and the material was applied on the day the burn was received in all but one patient who was treated with zinax 2½ days after injury.

CONCLUSIONS

Although our experience is limited, we believe the following conclusions are justified:

1. This procedure is far superior to any other local treatment for burns.

2. It is easily and quickly applied.

3. It can be used in the treatment of large numbers of burns.

4. Amelioration of pain and distress is marked and rapid after application of the dressing.

5. The incidence of infection in the burned areas is greatly reduced.

6. The loss of serum from the burned areas is prevented.

7. The patient is able to attend to many of his personal needs, thus reducing nursing care.

8. Transportation of patients treated by this method can be accomplished with minimal difficulty.

9. First and second degree burns can be healed in from 5 to 12 days.

10. Areas of third degree burns are self-debrided and ready for split grafts in from 12 to 14 days, which is sooner than has been our experience with any other local treatment.

11. Healing is accompanied with a minimum of scarring.

BOOK REVIEW

The New Military and Naval Dictionary, edited by *Frank Gaynor,* Editor, "Encyclopedia of Atomic Energy". 295 pages. Philosophical Library, New York, N. Y., publishers, 1951. Price $6.

This new dictionary is apparently written for nonmilitary personnel. Although it covers a wide range of words and phrases, the definitions are often too brief and noninformative. It will be useful, however, for personnel of any one of the services in interpreting phrases used by the other services. An interesting innovation for a military dictionary is the interpretation of slang expressions used by service personnel during World War II.—*Lt. Col. Carl J. Koehn, MSC, U. S. A.*

Combined Streptomycin-Tuberculin Therapy in Pulmonary Tuberculosis[1]

A Pilot Study

Eugene C. Jacobs, *Colonel, MC, U. S. A.*

Joseph R. Vivas, *Lieutenant Colonel, MC, U. S. A.*

THIS is a report of a method of medical management in pulmonary tuberculosis. It is generally acknowledged that streptomycin, being both tuberculostatic and tuberculocidal (2), exerts a powerful effect on the course of tuberculous infection. It is, however, becoming more and more apparent that certain factors prevent streptomycin from acting directly on the micro-organisms within tubercles.

For many years pathologists and phthisiologists have realized that many forms of tuberculosis, from the tubercle to the chronic far-advanced lesions, are avascular (3-10). It has also been noted that the avascularity of tuberculous lesions interferes with the action of streptomycin (11,12). Although it has been demonstrated that streptomycin can penetrate both the solid necrotic tubercles and the walls of cavities, the

(1) This work was done at the Walter Reed Army Hospital, Washington, D. C.

(2) Garrod, L. P.: Nature of action of streptomycin on tubercle bacilli. Am. Rev. Tuberc. 62: 582-585, Dec. 1950.

(3) Menkin, V., and Menkin, M. F.: Studies on inflammation; measure of permeability of capillaries in inflamed area. J. Exper. Med. 51: 285-293, Feb. 1930.

(4) Menkin, V.: Studies on inflammation; mechanism of fixation by inflammatory reaction. J. Exper. Med. 53: 171-177, Feb. 1931.

(5) Ravina, A.; Sourice, A.; and Benzaquen, L.: L'angiographie et l'angiopeumographie. Presse Méd. 40: 287-291, Feb. 20, 1932.

(6) Birkelo, C. C., and Brosius, W. L.: Roentgen visualization of pulmonary arterial circulation in autopsy material. Radiology 31: 261-292, Sept. 1938.

(7) Lopo de Carvalho; Egas Moniz; and Almeida Lima: L'angiopneumographie et son application dans la tuberculose pulmonaire. Presse Med. 40: 1098-1100, July 13, 1932.

(8) Steinberg, I.; McCoy, H. I.; and Dotter, C. T.: Angiocardiographic findings in pulmonary tuberculosis. Dis. Chest 19: 510-520, May 1951.

(9) Savacool, J. W., and Charr, R.: Thrombosis of pulmonary artery. Am. Rev. Tuberc. 1: 42-57, July 1941.

(10) Jacobs, E. C., and Kuhns, D. M.: Avascularity of tuberculous lesions; major problem in therapy. To be published.

(11) Morin, J.: Streptomycin therapy. Acta Tuberc. Belg. 40: 48, 1949.

(12) Maurer, G.: Cavernostomy and tamponade of pulmonary cavities with para-aminosalicylic acid. Dis. Chest 16: 676-683, Dec. 1949.

fact that a higher proportion of the bacterial population becomes resistant within these lesions, and resistant to a higher degree than in other lesions, indicates that streptomycin does not penetrate the tubercles in therapeutic concentrations *(13)*. Shamaskin et al. *(14)* made the following important statement: "Until another and more effective antibiotic against tuberculosis is discovered, we should change our mode of attack on this problem and aim our efforts primarily at finding means of penetrating more effectively the defenses behind which the tubercle bacilli may find protection in the human body. We must enable the drug to make adequate contact with the organism wherever it may be."

ATTEMPTS TO PENETRATE THE VASCULAR BARRIERS OF TUBERCLES

Various methods of penetrating the vascular barriers of tuberculosis are being tried. Cavernostomy is being used to drain cavities and to introduce the antituberculous agents directly into them *(12)*. Potassium iodide *(15-17)*, antihistaminic agents *(18, 19)*, detergent antibiotics *(20)*, and streptokinase *(21)* are being used in an attempt to soften or liquify the exudative lesions so that the antibiotic may come into closer contact with the micro-organism. Tuberculin *(22-24)* is being used in an effort to revascularize tubercles and thus permit greater penetration of the antibiotic.

RATIONALE OF TUBERCULIN IN THERAPY

Since the original studies of Virchow *(25)*, it has been generally accepted that tuberculin causes the formation of perifocal inflammatory reactions (increased vascularity) about tuberculous lesions. After

(13) Medlar, E. M.; Bernstein, S.; and Reeves, F. C.: Demonstration of streptomycin-resistant tubercle bacilli in necropsy specimens. Am. Rev. Tuberc. 63: 449-458, Apr. 1951.

(14) Shamaskin, A.; Des Autels, E. J.; Sweany, H. C.; Morris, L. C.; Zvetina, J. R.; and Mindlin, J.: Streptomycin in treatment of miliary and meningeal tuberculosis; based on study of 30 cases. Dis. Chest 16: 765-787, Dec. 1949.

(15) Woody, E., Jr., and Avery, R. C.: Combined effect of potassium iodide and streptomycin on established tuberculosis in guinea pigs. Science 108: 501-502, Nov. 5, 1948.

(16) Woody, E., Jr. ; Johnson, H. E. ; Avery, R. C.; and Crowe, R. R.: Combined effect of potassium iodide and streptomycin on far-advanced chronic pulmonary tuberculosis. Dis. Chest 19: 373-386, Apr. 1951.

(17) Rogue, F. T., and Cleve, E. A.: Tuberculous meningitis in children treated with combined streptomycin and potassium iodide. Dis. Chest 19: 319-324, Mar. 1951.

(18) Judd, A. R., and Henderson, A. R.: Use of antihistaminic drugs in human tuberculosis; preliminary report. Ann. Allergy 7: 306-317, 1949.

(19) Millner, T., and Hurst, A.: Tuberculosis and antihistaminics. Dis. Chest 16: 870-878, Dec. 1949.

(20) Grace, E. J., and Bryson, V.: Topical detergent antibiotics in treatment of tuberculous sinuses. Dis. Chest 16: 795-800, Dec. 1949.

(21) Cathie, I. A. B.: Streptomycin-streptokinase treatment of tuberculous meningitis. Lancet 256: 441-442, 1949.

(22) Cavoura, C.: Results of treatment of tuberculous meningitis in infants and children with streptomycin. Pédiatrie 37: 548-552, 1948 .

(23) Cairns, H.; Smith, H. V.; and Vollum, R. L.: Tuberculous meningitis. J. A. M. A. 144: 92-96, Sept. 9, 1950.

(24) Vivas, J. R., and Jacobs, E. C : Combined streptomycin-tuberculin therapy in pulmonary tuberculosis. Bull. U. S. Army M. Dept. 9: 1-9, Jan. 1949.

Virchow's report tuberculin was regarded by many to be a dangerous form of therapy, mainly because the increased vascularity had permitted a liberation of tubercle bacilli into the blood stream, and in a rare instance, had been followed by a spread of the disease. Recent use of tuberculin desensitization in conjunction with streptomycin indicates that it is a safe procedure. The liberation of tubercle bacilli into the blood stream in the presence of therapeutic levels of streptomycin is a highly desired feature of this form of therapy. The increased vascularity of the tubercles and the increased permeability of the involved vessels permit greater penetration of the antibiotic into the lesions, resulting in tuberculostatic and tuberculocidal actions on the contained organisms.

COMBINED STREPTOMYCIN-TUBERCULIN THERAPY

The method of administering the combined streptomycin-tuberculin therapy is described in another article *(26)*.

DISCUSSION

Of the accepted treatments for pulmonary tuberculosis, prolonged bed rest has held the foremost place for centuries, primarily because it was the only treatment known which would eventually lead to a cure. In the last decade it has gradually been realized that prolonged bed rest is detrimental to the health of the patient. Unfortunately the phthisiologist has had nothing to substitute for bed rest. Collapse therapy had been successful in curing not more than 15 percent of the patients with pulmonary tuberculosis. This left 85 percent to be treated by bed rest.

Within the last 6 years streptomycin has appeared as the first agent which has proved to be both tuberculostatic and tuberculocidal to the *Mycobacterium tuberculosis*. Although it has brought great hope to the phthisiologist, it has been disappointing because of: (1) its toxicity, (2) its inability to clear many cases, (3) the frequency of relapse, and (4) the emergence of many resistant tubercle bacilli *(27)*. The phthisiologist has not had sufficient confidence in the new antibiotic to substitute it for bed rest, but has preferred to use it as a supplement to bed rest. The toxicity has been largely overcome by giving smaller doses at greater intervals; there has been no noticeable decrease in the efficiency of the streptomycin when 0.5 gram is given twice daily. The inability of the streptomycin to clear many lesions is believed to be due to the avascularity and fibrous encapsulation of the tubercles, resulting in a failure of the antibiotic to penetrate into the lesions in sufficient concentration to produce tuberculostatic and tuberculocidal action against the contained micro-organisms.

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(25) Virchow, R.: Ueber die Wirkung des Koch'schen Mittelo auf innere Organe Tuberculöser. Berl. klin. Wchnschr. 28: 49-54, 1891.

(26) Jacobs, E. C., and Vivas, J. R.: Combined streptomycin-tuberculin therapy in pulmonary tuberculosis: method of treatment. To be published.

(27) Council on Pharmacy and Chemistry, American Medical Association: Streptomycin in treatment of tuberculosis. J. A. M. A. 138: 584-593, Oct. 23, 1948.

By adding tuberculin to streptomycin, the vascularity of the lesions and the permeability of the involved vessels are increased (3,4,25) allowing greater penetration of the antibiotic into them. The frequent relapses of pulmonary tuberculosis within a few months after treatment with streptomycin are thought to be due to the tendency of streptomycin to prevent the formation of fibrous tissue (28) while it is clearing the exudative lesions. Thus little or no protection is left against future reactivation of the lesions.

By adding tuberculin desensitization to the streptomycin therapy, focal reactions are produced about the tubercles. Like other inflammatory reactions, they tend to heal by formation of fibrous and scar tissues which are relatively impermeable barriers against future hydration, hyperemia, and inflammation. The resistance of tubercle bacilli to streptomycin is believed to be due to the low levels of antibiotic within the avascular and encapsulated lesions.

By adding tuberculin desensitization to streptomycin therapy and effecting an increased vascularity of the tuberculous lesions, and an increased permeability of the involved vessels, it is believed that the streptomycin is able to penetrate and diffuse into the lesions in sufficient concentration to result in tuberculostatic and tuberculocidal action rather that the emergence of increased resistance of the microorganisms to the antibiotic.

RESULTS OF THE COMBINED STREPTOMYCIN-TUBERCULIN THERAPY

Although the combined streptomycin-tuberculin therapy has been used for only 4 years, and this report represents the treatment of a rather small number of patients with pulmonary tuberculosis, it is believed that the results (abeyance of clinical symptoms; roentgenographic improvement; sputum conversion; decrease in sedimentation rate, pulse, and temperature; and increase in appetite, weight, and well-being) have been more rapid than in any similar series treated by streptomycin and other agents. Table 1 presents the results of treatment by this method of the first series of 24 consecutive (unselected) patients with pulmonary tuberculosis. These patients have been observed for from 2 to 4 years. Nineteen remain alive; 8 are apparently cured; 8 are arrested; and 3 have active tuberculosis, but are otherwise in good health.

At present, more than 100 patients with tuberculosis have been treated by more than 200 courses of the combined streptomycin-tuberculin therapy. There have been no untoward results. Toxicity has been of little significance. Clinical improvement, sputum conversion, and roentgenographic clearing, both during and following combined therapy, have been more rapid than in any series treated by streptomycin and

(28) Auerbach, O., and Stemmermann, G. N.: Anatomic Change in tuberculosis following streptomycin therapy. Am. Rev. Tuberc. 58: 449-462, Oct. 1948

TABLE 1. *Results of treatment*

Type of disease	Clinical improvement				Sputum conversion		Streptomycin resistance		Roentgenographic improvement				Total number of cases
	N	S	Mod	Mkd	Yes	No	Yes	No	N	S	Mod	Mkd	
Acute*													
Minimal	0	1	0	0	1	0	0	1	0	1	0	0	1
Moderate	0	0	3	3	6	0	0	6	0	0	0	6	6
Advanced	1	0	2	1	3	1	0	4	1	0	2	1	4
Subtotal	1	1	5	4	10	1	0	11	1	1	2	7	11
Chronic**													
Minimal	0	2	2	0	4	0	0	4	0	3	1	0	4
Moderate	0	1	3	0	2	2	0	4	0	1	3	0	4
Advanced	0	3	1	1	0	5	2	3	1	3	1	0	5
Subtotal	0	6	6	1	6	7	2	11	1	7	5	0	13
Total	1	7	11	5	16	8	2	22	2	8	7	7	24

*One died of bronchogenic carcinoma; his tuberculosis was well controlled by therapy. Another died at Fitzsimons Army Hospital of tuberculosis, diabetes, and arteriosclerosis 1 year following excellent results by combined therapy.

**One died of lobar pneumonia. He was seriously ill on admission and lived in the hospital for 3 months. He was 68 years old. His prognosis appeared hopeless from the time of admission. Another died of advanced tuberculosis. He was seriously ill on admission but lived 24 months in the hospital. He was markedly improved on 3 occasions following combined therapy. He was 80 years old. A third died of myelogenous leukemia. Her tuberculosis was well controlled on 2 occasions by combined therapy. Terminal spread of her tuberculosis followed the use of ACTH for her leukemia.

N = none, S = slight, Mod = moderate, Mkd = marked

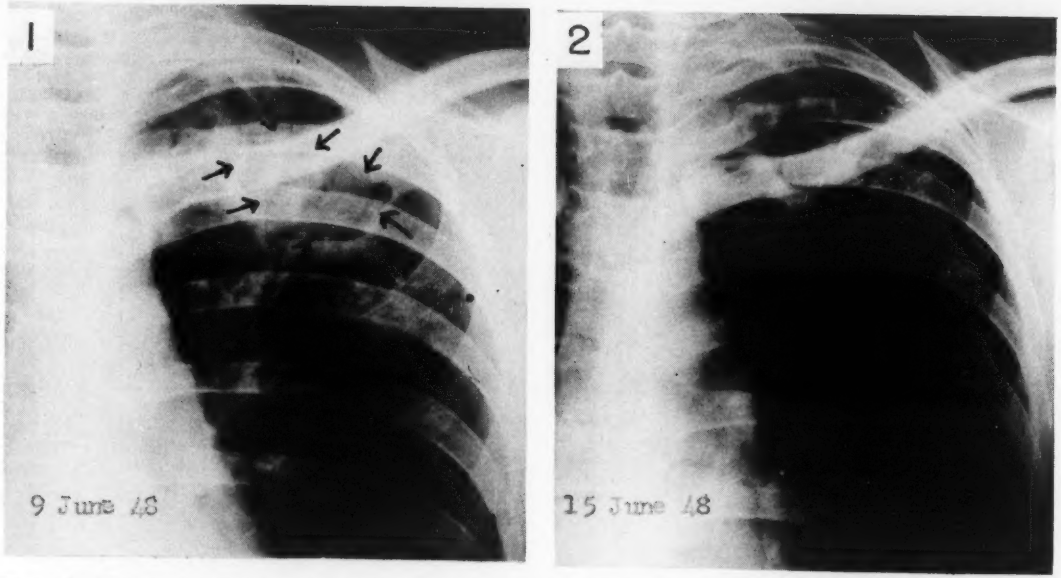
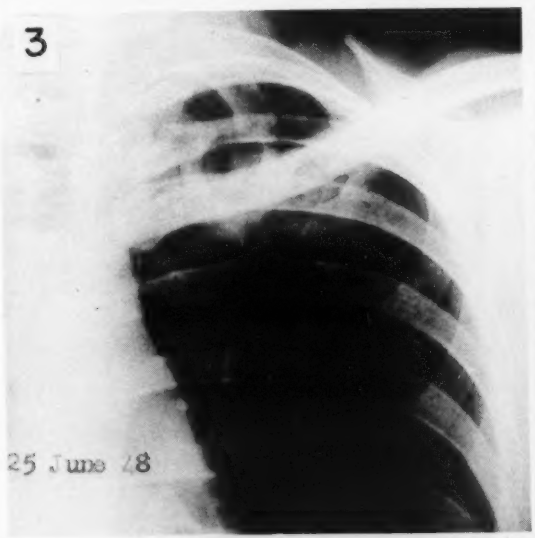


Figure 1. Roentgenogram of chest of a 28-year-old Negro soldier at beginning of therapy (9 June 1948). Figure 2. Same patient on 15 June 1948.



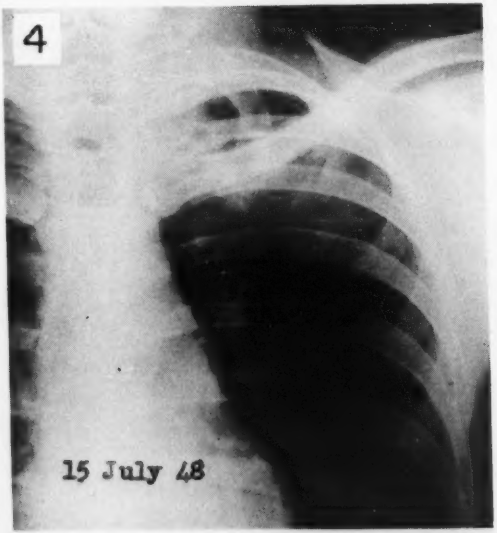


Figure 3. Same patient on 25 June 1948. Figure 4. Same patient on 15 July 1948. Note perifocal inflammatory reaction.

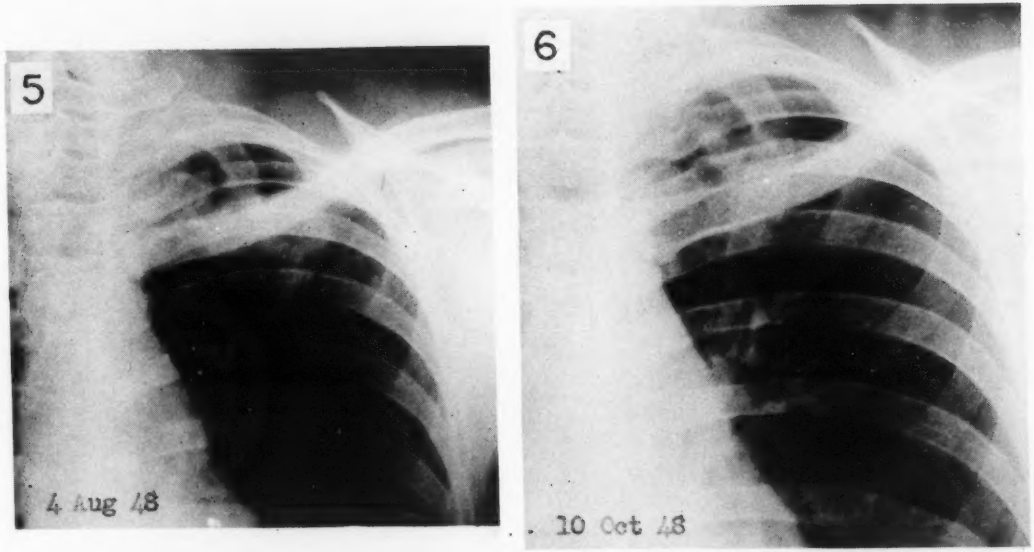


Figure 5. Same patient at termination of combined streptomycin-tuberculin therapy (4 August 1948). Figure 6. Same patient 2 months later (10 October 1948). Considered cured at that time.

other agents. Roentgenograms of a patient treated by this method with typical results are shown in figures 1-6. Relapses have been rare after the sputum has been converted consistently for as long as 6 months.

Of the 22 patients in whom the sputum was not converted by combined therapy, the emergence of resistance to 15 micrograms or more of streptomycin has occurred in only 2 (9 percent). This corresponds favorably with the best results obtained by combinations of streptomycin and other antituberculous agents.

CONCLUSIONS

The clinical, laboratory, and roentgenographic improvement during and following treatment with combined streptomycin-tuberculin therapy have been more rapid than in any similar series treated by streptomycin and other agents. There have been no untoward results. Toxicity has been of little significance. Relapses have been uncommon. Resistance to streptomycin has developed in only 9 percent of the patients in whom the sputum remained unconverted. The relatively short period (2 months) of hospitalization necessary when the combined therapy is used, eases the economic burden on the patient and his family and permits the hospitalization of a greater number of patients.

If the above findings are confirmed by others, it will mean that patients with minimal pulmonary tuberculosis can be treated and cured before they become therapeutic problems, and many patients with chronic far-advanced tuberculosis in whom the prognosis is poor can with repeated courses of treatment gain much clinical improvement.

BOOK REVIEWS

The Essentials of Modern Surgery, edited by *R. M. Handfield-Jones,* M. C., M. S., F. R. C. S., Senior Surgeon to St. Mary's Hospital; Lecturer in Surgery, St. Mary's Hospital Medical School; Member of the Court of Examiners, R. C. S., and Examiner in Surgery to the University of London; Late Hunterian Professor, R. C. S., and *Sir Arthur E. Porritt,* K. C. M. G., C. B. E., M. A., M. Ch., F. R. C. S., A Surgeon to His Majesty the King; Surgeon, St. Mary's Hospital and Royal Masonic Hospital; Consulting Surgeon, Acton, North Herts and South Beds, Teddington, Hampton Wick and District, and Paddington (L. C. C.) Hospitals; Examiner in Surgery, University of Cambridge. 4th edition. 1263 pages; 644 illustrations. The Williams and Wilkins Co., Baltimore, Md., publishers, 1951. Price $11.

This single comprehensive volume covers its subject from "Abbott's jacket for Scoliosis" to "Zukerkandl, fascia of." The writing is concise and condensed and the choice of title is fortunate. All surgical specialties are included with almost equal emphasis and the volume could

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well have been titled "A One-Volume Encyclopedia of Modern Surgery." The authors have succeeded in compiling a text for general surgery. The presentation is orderly and well classified with a good index and the text should be heartily greeted by the medical student. To some extent the popularity and acceptance of this volume will depend on the rebirth of the general practitioner for whom it should serve as a good source of quick reference to refresh his memory on almost any of the essentials of modern surgery.

A few anachronisms persist such as the advice given in the general treatment of inflammation, "Diet should be reduced to its most nutritious as well as easily assimilable form, e. g., milk, meat juices and extracts, chicken and calves foot jelly, etc." and in the use of a Bier's or Klapp's suction cup to produce local hyperemia. One unusual feature is the 29-page section on venereal diseases with little or no surgical importance in this day of chemotherapy. These, however, are minor shortcomings in the execution of a difficult task and the authors have succeeded admirably in presenting modern surgery in its essence.

—*Commander R. M. Mugrage, MC, U. S. N.*

Space Medicine, The Human Factors in Flights Beyond the Earth, edited by *John P. Marbarger*, Associate Professor of Physiology, College of Medicine, and Director of Research in the Aeromedical and Physical Environment Laboratory, University of Illinois. 82 pages; illustrated. The University of Illinois Press, Urbana, Ill., publisher, 1951. Price $3.

Stimulated by the establishment of the Department of Space Medicine at the U. S. Air Force School of Aviation Medicine in 1949, a group of serious and distinguished scientists met in Chicago at the Professional Colleges of the University of Illinois on 3 March 1950 to discuss the present aeromedical knowledge adaptable to the problems involved in human flight beyond the stratosphere. This small volume, which is probably the first of its kind, contains 6 articles presented at this symposium which may well serve as the starting point for investigation in this fascinating field of aviation medicine.

In the opening chapter, Major General Harry G. Armstrong, Surgeon General of the Air Force, describes the historical background of space medicine, in which the USAF School of Aviation Medicine has pioneered, and predicts that space flight will someday be reality. Other chapters cover the development of multistage rockets, the physiologic considerations on the possibility of life under extraterrestrial conditions, the relation of astronomy to space medicine, the problem of orientation in space, and, finally, the bioclimatology of manned rocket flight.

This book is easy to read and is recommended to all physicians who desire to have, at least, a nodding acquaintance with the subject. It will be welcomed by all workers in the specialty of aviation medicine.—*Col. R. J. Benford, U. S. A. F. (MC)*

Adenocarcinoma of the Appendix[1]

Bruce R. McCampbell, *Commander, MC, U. S. N.*

Everett H. Dickinson, *Captain, MC, U. S. N.*

ADENOCARCINOMA arising in the appendix is rare. In the military service where appendectomy is a frequent operation the possibility of carcinoma should be kept in mind and when present it should be recognized. Carcinoma of the appendix has been divided pathologically into three types by Uihlein and McDonald (2): (1) carcinoids, (2) carcinomas of the mucous type producing pseudomyxoma peritonei, and (3) carcinomas which resemble both grossly and microscopically the type seen in the colon, the colonic type. It is with a carcinoma of the appendix of this last type that this report deals.

It is difficult to evaluate the reported incidence of primary carcinoma of the appendix of the colonic type because of its rarity and because the incidence rates vary in different series. Harryman (3) reviewed 24,849 surgically removed appendixes and found only one tumor of this type; Reitz (4) found 2 adenocarcinomas in 2,520 specimens. One of these tumors might have been more properly classified as the mucous type, because it was described as a tall cell or gelatinous carcinoma. It is apparent that in the series reported by Reitz the incidence is about 20 times greater than in Harryman's series. Uihlein and McDonald (2) classified all of the tumors of the appendix (144) found at the Mayo Clinic from 1910 to 1941 as follows: (1) 127 carcinoids (82.2 percent); (2) 12 cystic carcinomas (8.3 percent); and (3) 5 carcinomas of the colonic type (3.5 percent). Crile and Glenn (5)

(1) From U. S. Naval Hospital, Oakland, Calif.

(2) Uihlein, A., and McDonald, J. R.: Primary carcinoma of appendix resembling carcinoma of the colon. Surg., Gynec. & Obst. 76: 711-714, June 1943.

(3) Harryman, J. E.: Mucoid carcinoma of the appendix with pseudomyxoma peritonei, case report. Harper Hosp. Bull. 5: 118-126, Aug. 1947.

(4) Reitz, C. B.: Carcinoids, malignant carcinoids, and carcinoma of vermiform appendix. Hahneman. Monthly, 81: 230-239, June 1946.

(5) Crile, G. Jr., and Glenn, C. G.: Primary adenocarcinoma of appendix with development of mucus fistula. U. S. Nav. M. Bull. 47: 328-330, Mar.-Apr. 1947.

reported a case of primary adenocarcinoma of the appendix in a man, 48 years old, who was thought at operation to have an appendiceal abscess. The area was drained and a chronic sinus formed which discharged mucus continuously until another exploratory operation was performed 3 months later when a large papillary carcinoma in the appendix was found. It had not metastasized. Maisel and Foot (6) reported an unusual case in a man with multiple polyposis of the colon in which an adenocarcinoma of the appendix, independent of another carcinoma of the cecum, was found. The case we are reporting here was the only carcinoma of the colonic type found in 1,079 appendixes surgically removed between September 1947 and April 1951 at this hospital.

CASE REPORT

A 53-year-old man was admitted to this hospital on 5 April 1950 with a diagnosis of myocardial infarction based on electrocardiographic tracings. He gave a history of a sudden onset of severe chest pain 2 days prior to admission. On admission the pulse rate was 104, the blood pressure was 118/85. There was no cardiac enlargement. The heart sounds were distant but were otherwise normal. No masses or areas of tenderness were palpable in the abdomen. The patient had no acute distress.

The white blood cell count was 12,950 with 83 percent segmented neutrophils. The hemoglobin was 12.5. The sedimentation rate was 26. A roentgenogram of the chest taken on 11 April revealed no abnormalities. The ECG showed evidence of a recent posterior infarction of the myocardium. The patient was treated with sedation, bed rest, and dicumarol. His prothrombin time was maintained at about 33 percent of normal with a low of 12 percent on 18 April and 15 percent on 21 April.

On 22 April his eighteenth day in the hospital he complained of a pain in his abdomen. He stated that it began 2 days previously as a generalized pain in the lower abdomen and had become localized in the right lower abdominal quadrant. He also had anorexia and nausea. His temperature was 99.2° F. and his pulse rate was 108. He did not appear to be acutely ill. His abdomen was mildly distended and diffusely tender, the maximum tenderness being at McBurney's point. Rebound tenderness was present at this point. His urine contained 50 mg. of albumin per 100 cc. and was loaded with red blood cells. The white blood cell count was 10,600, with 75 percent segmented neutrophils, 3 percent band forms, 20 percent lymphocytes, and 2 percent monocytes. A diagnosis of acute appendicitis was made.

Under ether anesthesia an appendectomy was performed. The appendix was found to be enveloped in a mass of omentum. It was dissected free from the omentum and found to be gangrenous in the

(6) Maisel, B., and Foot, N. C.: Multiple polyposis of colon with malignant change involving colon and appendix; case report. Ann. Surg. 126: 262-269, Sept. 1947.

midportion. It was removed and the stump was treated with phenol and alcohol but was not inverted. The patient showed little tendency to bleed in spite of the low prothrombin time. He made an uneventful recovery. The appendix was 3 cm. in length and encased in a mass of omental fat. The distal portion was 1.5 to 2 cm. in diameter and its wall was white and firm. Its lumen was obliterated. (fig. 1).

Figure 1. Cut sections of appendix.

The microscopic section across the base revealed a thickened mucosa and a small lumen. Small lymphoid follicles were present in the submucosa. There was a large amount of fatty tissue beneath the inner circular layer of muscle. The muscle layers were intact but there were several small extravasations of red blood cells in them. The subserosal vessels were dilated, packed with red blood cells, and showed some degree of margination of the polymorphonuclear leukocytes. Sections from the dilated distal portion of the organ displayed a startling hyperplasia of the mucosa. (fig. 2). Papillary outgrowths supported on tenuous connective tissue stalks filled and dilated the lumen. Rounded groups of columnar cells surrounding irregular lumens were seen deep in the wall of the appendix infiltrating the muscular coats and apparently completely detached from the mucosa. There were large collections of a pale-staining, fibrinoid, apparently mucous, material, incarcerated in the submucosa. The cells of the papillary projections and of the deeply situated adenoid structures were crowded together, having darkly-staining, somewhat irregular nuclei, and displaying a large amount of mitotic activity. There was a marked loss of polarity in many instances. The cytoplasm of the cells was abundant and often was filled with large clear vacuoles. The serosa was greatly thickened by a marked overgrowth of fibroblasts intermingled with extravasated red blood cells, polymorphonuclear leukocytes, and fibrin. There were

several points of necrosis in the serosa. One section revealed an irregular group of columnar epithelial cells attached to the serosal surface of the mesoappendix, partially enclosing a mass of pale-staining mucus. The distal portion of the appendix was conspicuously devoid of lymphoid tissue. A diagnosis of primary adenocarcinoma of the appendix associated with acute fibrinopurulent appendicitis was made.

Figure 2. Microscopic section of distal portion of appendix.

The patient was presented to the Tumor Board and it was decided that a right hemicolectomy should be performed. This was done on 25 May. The terminal ileum, cecum, ascending colon, and right half of the transverse colon were resected and an end-to-side ileotransverse colostomy was performed. The pathologist was unable to find any evidence of the neoplasm in the cecum, appendiceal stump, or lymph nodes. The patient made an uneventful recovery and was living and well without evidence of recurrence 1 year after operation.

DISCUSSION

Anderson (7) stated that adenocarcinoma of the appendix, although rare, is identical in appearance with carcinoma of the colon. The neoplasm is said to involve either the tip or the base of the appendix, usually the latter. In our case the distal end was involved. The neoplasm may be either polypoid or ulcerating and the symptoms may vary accordingly. The polypoid tumors produce obstruction of the lumen and acute appendicitis, and the ulcerating lesions produce melena and anemia. The fact that symptoms of appendicitis are usually recognized by the patient, causing him to seek surgical treatment early, accounts for the excellent results obtained because the tumor is removed before metastasis occurs. When metastasis does occur, which is usually late in the disease, it is to the regional lymph nodes and to the liver. The appendiceal carcinoma in our patient was unsuspected until the pathologist reported its presence. The diagnosis would have been at least suspected in this case had the operating surgeon opened the appendix.

The treatment usually consists of a simple appendectomy because the tumor is not identified until several days later, and it is then found that complete removal of the neoplasm was probably accomplished, and no further operation is considered necessary. If the carcinoma extends into the wall of the cecum, Harryman (3) recommends resection of the cecum using the technic of Jones and Carmody (8). We believe that the treatment of choice is a right hemicolectomy, because this procedure fulfills the criteria of the surgical treatment of cancer in other localities, which is the most radical and yet feasible surgical procedure as soon as the diagnosis of carcinoma is made. The recommended operation removes the neoplasm completely and also any metastatic nodes that may be present. It is the most logical procedure for such a potentially dangerous lesion.

It is desired to make a plea for the surgeon to inspect or have the pathologist examine all the tissue removed at operation. Failure to do this is reprehensible because: (1) it often allows a malignant lesion to be unsuspected and be inadequately treated at the time of the initial operation, (2) the surgeon misses the opportunity to refresh his knowledge of gross pathology at each operation; after the specimen has been placed in a fixative and sent to the pathologist it involves a greater effort for him to go there and examine the specimen; and (3) the tissue may be lost between the operating room and the laboratory. If the surgeon has not examined the specimen, then no one is able to make a diagnosis.

(7) Anderson, W. A. D.: Pathology. C. V. Mosby Co., St. Louis, Mo., 1948.

(8) Jones, T. E., and Carmody, M. G.: Mucocele of appendix; report of two cases, one causing intussusception and partial intestinal obstruction. Am. J. Surg. 32: 511-515, June 1936.

BOOK REVIEWS

British Scientists, by *E. J. Holmyard,* M. A., M. Sc., D. Litt., F. R. I. C., Editor of Endeavor, Memre Correspondant de l'Academie Internationale d'Histoire des Sciences, Vice-President of the British Society for the History of Science, Chairman of the Society for the Study of Alchemy and Early Chemistry. 88 pages; illustrated with 24 portraits. The Philosophical Library, Inc., New York, N. Y., publishers, 1951. Price $2.75.

This pocket-size volume contains a brief account of the outstanding accomplishments of noted British scientists including Roger Bacon, William Gilbert, John Napier, William Harvey, Robert Boyle, Isaac Newton, James Hutton, Joseph Black, Joseph Priestley, Henry Cavendish, John Dalton, Humphrey Davy, William Herschel, Michael Faraday, Charles Darwin, Lord Kelvin, James Clerk Maxwell, Lord Lister, William Crookes, William Perkin, James Dewar, William Ramsay, J. J. Thomson, and Lord Rutherford. There are also paragraphs on the Royal Society, the Royal Institution, and the Royal Society of Edinburgh. The book is well written and in portraying these scientists, the author traces the development of modern science. Each sketch is accompanied by a portrait of the scientist.—*Col. H. R. Gilmore, Jr., MC, U. S. A.*

The Electrical Activity of the Nervous System, A Textbook for Students, by *Mary A. B. Brazier,* B. Sc., Ph. D. (London), Neurophysiologist, Massachusetts General Hospital; Research Associate, Harvard Medical School. 220 pages; illustrated. The Macmillan Company, New York, N. Y., publishers, 1951.

To read the preface of this volume first is a mistake for the allegation of the author that this is a text for students stimulates question as to the need for such a book when such material is presented in any of the better physiology texts. Reading the text corrects this misconception for the author has concisely, succinctly, and even cleverly, by the use of well-chosen words and simple diagrams, presented in logical progression the known information on the electrical activity of nerves. It must be the clarity resulting from leading the reader stepwise through this difficult subject and the occasional arbitrary emphasis of one of many conflicting opinions that has caused the author to think of this as a work for the beginning student. Although the beginner would profit, so would any lecturer in physiology preparing his lecture notes on this subject; so, too, would any researcher in planning or reviewing a program in this field. The knowledge and the gaps in understanding of the electrical activity of the nervous system are clearly pointed out. The major deficiency which arises from the commendable effort to keep the book small is that not all details nor all references could be catalogued so the advanced worker must use additional sources.

—*A. H. Lawton, M. D. Ph. D.*

Acne Vulgaris and the Urinary 17-Ketosteroids in Young Men

Claude B. White, *Colonel, U. S. A. F. (MC)* (1)
Addelia Peterson (2)
Jane C. Neff, *B. S.* (2)

MEDICAL lore is replete with clinical impressions suggesting an important relationship between the endocrine glands and acne vulgaris. Dermatologists such as Pick, Hollander, Darier, Bloch, Stein, and Schamberg have favored this opinion. In 1783 von Plenck (3) referred to the popular belief that marriage cures pimples. The modern concept of the pathogenesis of acne vulgaris favors an imbalance between the androgenic and estrogenic substances with the emphasis on an androgenic preponderance (4). Although Sulzberger and Witten (5) have written that it is the ratio of circulating androgens to estrogens which is important as related to acne vulgaris, rather than alteration of one or the other component alone, a search of the literature fails to reveal a definitive experimental basis for this theory. A review of the work of several investigators (6-17) demonstrates the need for further work and more knowledge along these lines.

(1) Brooke Army Hospital, Fort Sam Houston, Tex.
(2) Fourth Army Area Laboratory, Fort Sam Houston, Tex.

(3) von Plenck, J.: Doctrina de Morbis Cutaneis. 2d edition. R. Graeffer, Vienna, 1783. p. 60. Cited by Wittkower, E.: Acne vulgaris; psychomatic study. Brit. J. Dermat. 63: 214-223, June 1951.

(4) Sulzberger, M. B., and Baer, R.: Acne vulgaris and its management. In Sulzberger, M. B. (editor): Year Book of Dermatology and Syphilology. Year Book Publishers, Inc., Chicago, Ill., 1949. pp. 9-39.

(5) Sulzberger, M. B., and Witten, V.: Hormones and acne vulgaris. M. Clin. North America 35: 373-390, Mar. 1951.

(6) Rosenthal, T., and Kurzrok, R.: Excretion of estrin in acne. Proc. Soc. Exper. Biol. & Med. 30: 1150-1151, May 1933.

(7) Rosenthal, T., and Neustaedter, T.: Estrogenic substance in blood of patients with acne. Arch. Dermat. & Syph. 32: 560-562, Oct. 1935.

(8) Wile, U. J.; Snow, J. S.; and Bradbury, J. T.: Studies of sex hormones in acne; urinary excretion of androgenic and estrogenic substances. Arch. Dermat. & Syph. 39: 200-210, Feb. 1939.

Because biologic technics using animals for the assay of androgenic materials are cumbersome, tiresome, and expensive, they have not been widely applied to the problem of acne vulgaris. In the several instances where biologic technics have been used, too often variance in technics and the use of different measuring units have made comparisons difficult and conclusions questionable. Wile, Snow, and Bradbury (8) employing a biologic assay method for measuring androgen excretion (capon comb growth response), have found that patients of both sexes with acne vulgaris secrete larger amounts of androgen than do normal persons of corresponding age.

It is fairly well established that the measurement of the urinary 17-ketosteroid excretion furnishes a satisfactory index of androgenic activity (18). These urinary 17-ketosteroids are believed to represent the end products of androgenic catabolism. The test has deficiencies but, until better tools are available for the study of such hormones, it will probably continue in use. In the past decade a new colorimetric method for assaying the urinary 17-ketosteroids has been introduced and standardized. Zarrow et al. (19) have found a high degree of correlation to exist between this method and the more laborious biologic assay employing animals and they have concluded that the biologic assay for urinary androgens contributes little information not afforded by the urinary 17-ketosteroid chemical determination. A comprehensive monograph concerning the origin, determination, and significance of the 17-ketosteroids has recently been compiled by Mason and Engstrom (18). Also Escamilla (20) has reported on an extensive clinical

(9) Cornbleet, T., and Barnes, B.: Hormones and acne vulgaris; urinary assay for and therapeutic use of androgen. Arch. Dermat. & Syph. 40: 249-252, Aug. 1939.

(10) Sulzberger, M. B.; Rostenberg, A., Jr.; and Sher, J. J.: Acneform eruptions, with remarks on acne vulgaris and its pathogenesis. New York State J. Med. 34: 899-908, Nov. 1, 1934.

(11) McCarthy, L., and Hunter, O. B.: Failure of therapy with glandular preparations in acne vulgaris. Arch. Dermat. & Syph. 35: 211-225, Feb. 1937.

(12) Lawrence, C. H., and Werthessen, N. T.: Etiology of acne in females. Internat. Clin. 1: 198-205, Mar. 1942.

(13) Van Studdiford, M. T.: Effect of hormones of sex glands on acne. Arch. Dermat. & Syph. 31: 333-342, Mar. 1934.

(14) Barber, H.: Hormone factors in acne. In MacKenna, R. M. B. (editor): Modern Trends in Dermatology. Paul B. Hoeber, Inc., New York, N. Y., 1948. p. 125.

(15) Way, S., and Andrews, G.: Hormones and acne. Arch. Dermat. & Syph. 61: 575-588, Apr. 1950.

(16) Cohen, E. L.: Endocrine factors in acne vulgaris. Brit. J. Dermat. 53: 231, Aug.-Sept.; 269, Oct. 1941.

(17) Goldzieher, M. A.: Endocrine pathogenesis and treatment of acne vulgaris. M. Rec. 160: 725-727, Dec. 1947.

(18) Mason, H. L., and Engstrom, W. W.: The 17-ketosteroids; their origin, determination and significance. Physiol. Rev. 30: 321-374, July 1950.

(19) Zarrow, M. X.; Munson, P. L.; and Salter, W. T.: Comparison of androgens determined biologically and 17-ketosteroids determined chemically in urine (normal and abnormal). J. Clin. Endocrinol. 10: 692-702, July 1950.

(20) Escamilla, R.: Diagnostic significance of urinary hormonal assays. Ann. Int. Med. 30: 249-290, Feb. 1949.

investigation of the 17-ketosteroids in a miscellany of medical ailments. Still, we are unaware of any reported investigations which apply the urinary 17-ketosteroid assay to the study of young men with acne vulgaris.

During 1949 and 1950, we performed urinary 17-ketosteroid assays, using a group of hospitalized patients with acne vulgaris. An endeavor had been made to clarify the probable and casual relationship of androgens to acne vulgaris and also to accumulate background control data for later additional investigations with endocrine therapy. Unfortunately at the time, urinary estrogenic assays were not freely obtainable at our laboratory.

CLINICAL MATERIAL AND PROCEDURE

Twenty-six young men between the ages of 14 and 30 years comprise this study. Twenty-three of these fell into the age group between 18 and 24 years. All the clinical varieties of acne were represented and all were classified either as severe or moderate in degree. In most, the condition was of over 1 year's duration, had become intractable, and was associated with such military duties as long marches, assignments in the Tropics, or excessive sweating. All patients were hospitalized and generally had been transferred from distant locales because of the severity of their lesions and also because of their unresponsiveness to usual therapy. All patients were placed on a comparable therapeutic regimen and the duration of study averaged about 3 months for each.

Twenty-four hour urine specimens were collected on admission and thereafter at weekly intervals. Records were maintained on the urine volumes. These served as a rough check on the accuracy of collections which were carefully supervised. The technic employed in the 17-ketosteroid determination was that of the standard Army Medical School technic (after Cahen and Salter *(21)*). Using this method, the normal values for men are between 8.1 to 22.6 mg. (as androsterone) per 24 hours. This agrees closely with the values cited by Mason and and Engstrom *(18)* who give the mean values of 17-ketosteroid excretion for men, obtained by some application of the Zimmerman reaction, as lying between 12.5 and 16.7 mg. per 24 hours, with a lower limit of normal at about 6 mg. and an upper limit at about 25 mg. per 24 hours.

RESULTS

One hundred and thirty-six separate 17-ketosteroid determinations were performed at weekly intervals. These weekly values for the urinary 17-ketosteroids were averaged, giving particular heed to the age of the patient and the severity of the acne lesions (table 1). The average

(21) Cahen, R. L., and Salter, W. T.: Urinary 17-ketosteroids in metabolism; standardized chemical estimation. J. Biol. Chem. 152: 489-499, Mar. 1944.

TABLE 1. *Urinary 17-ketosteroid excretions in young men with acne vulgaris*

Patient	Age (years)	Severity	Duration of observation (days)	Number of tests*	Average urine volume (cc./24 hr)	17-ketosteroid range (mg./24 hr.)		
						Low	High	Average
1	14	Severe	49	6	1168	9.5	18.2	12.9
2	17	Moderate	70	6	1385	10.6	21.9	15.6
3	18	Severe	231	12	1400	3.7	11.9	7.6
4	18	Moderate	84	11	1704	3.8	12.9	8.4
5	18	Moderate	133	12	1088	4.3	20.3	10.3
6	18	Severe	140	3	1252	8.6	13.7	11.2
7	18	Severe	126	3	1525	11.9	13.8	12.9
8	19	Moderate	77	3	1095	4.8	7.4	5.8
9	19	Moderate	98	2	1185	9.1	10.5	9.8
10	19	Moderate	56	2	870	12.9	14.9	13.9
11	19	Severe	161	11	1513	10.2	20.1	14.0
12	20	Moderate	70	7	1815	10.0	19.3	13.8
13	20	Moderate	14	1	1330	14.3	14.3	14.3
14	20	Severe	91	6	989	10.3	21.4	14.5
15	20	Moderate	42	6	932	9.6	20.1	15.3
16	20	Severe	77	2	1335	15.8	18.3	17.0
17	20	Moderate	161	11	1449	2.7	27.1	17.7
18	20	Severe	91	3	700	17.0	24.8	21.8
19	21	Severe	49	5	1611	5.0	12.9	8.9
20	21	Severe	84	3	1125	8.9	10.7	9.6
21	22	Severe	63	6	1166	12.9	22.9	18.8
22	22	Moderate	119	3	1075	16.6	22.1	19.7
23	23	Moderate	28	3	1660	12.9	15.6	14.3
24	24	Severe	133	2	1950	13.6	23.7	18.6
25	24	Moderate	42	4	2211	18.9	24.0	20.3
26	30	Moderate	35	3	1860	8.6	11.9	10.2
Average	20		89	5.2	1379	10.3	17.5	13.1

*Most tests for 17-ketosteroid were performed at weekly intervals.

*Most tests for 17-ketosteroid were performed at weekly intervals.

TABLE 2. *Weekly variation in 17-ketosteroid excretion (mg. per day) in 12 patients with acne vulgaris (96 determinations)*

Week	Patient											
	1	2	3	4	5	11	12	14	15	17	19	21
1st	18.2	21.9	7.2	8.9	7.7	15.9	16.8	12.2	9.6	20.3	12.9	21.1
2nd	11.9	15.3	9.8	12.9	4.3	15.7	15.5	13.1	18.1	27.1	11.4	19.2
3rd	9.8	10.6	9.5	9.1	14.8	12.4	11.8	10.3	13.6	14.2	8.0	20.1
4th	9.5	13.7	7.1	8.8	10.1	12.9	19.3	11.2	12.8	16.1	7.5	12.9
5th	14.4		7.2	8.7	13.0	12.2	11.4	21.4	17.3	17.1	5.0	16.6
6th	13.4	13.2	7.2	9.3	11.0	10.9	11.8	18.7	20.1	15.1		22.9
7th			11.9	8.3	12.9	20.1				14.9		
8th			6.5	7.7	6.9	19.4	10.0			24.4		
9th			10.6	8.4	12.2	12.2				2.7		
10th		18.9	5.4	7.1	20.3	10.2				24.9		
11th			3.7	3.8	11.9	11.2				18.5		
Average deviation* (percent)	15	23	29	13	30	22	20	29	22	27	30	17

*Average deviation from mean calculated according to the method of Kenigsberg et al. (22).

for the entire group was found to be 13.1 mg. per 24 hours. This value falls well within the average level for healthy young men in this age group. No correlation was observed between the severity of the acne lesions and the level of the 17-ketosteroids—patient 3 with severe lesions of acne maintained a 17-ketosteroid average of 7.6 mg., no single determination exceeding 11.9 mg. although a total of 12 tests were made. Contrariwise, patient 17 with a moderate degree of acne excreted the highest single quantity of 17-ketosteroid (27.1 mg.). The average for the series of 12 patients classified as having a severe degree of acne was 12.9 mg. whereas the comparable average for the series of 14 patients having lesions classified as moderately severe was 13.6 mg. This slight difference is of no statistical significance.

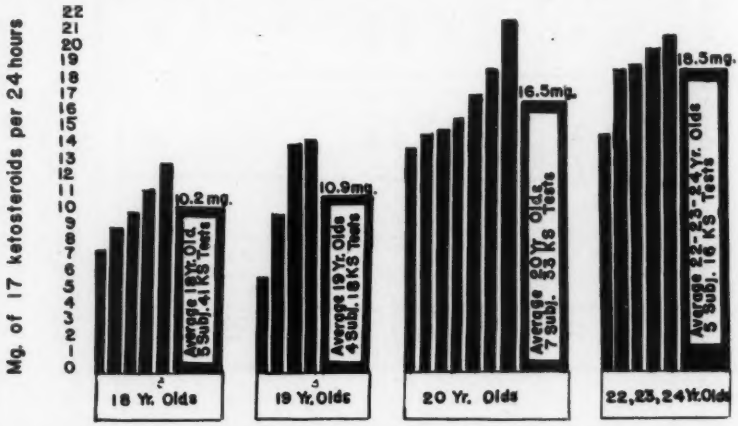

Figure 1. 17-ketosteroid excretion in patients of various ages with acne vulgaris (108 ketosteroid determinations on 21 patients).

The tendency toward an increase in the 17-ketosteroid values associated with an increase in age in years was evident in this study and is depicted in figure 1. These increased values in the patients with acne vulgaris correspond closely to the results observed by Kenigsberg et al. *(22)* and others *(18, 23)* in studies performed on normal young men.

The variations from week to week in the 17-ketosteroid output in 12 patients is shown in table 2. Particular attention was given to these variations because conceivably, wide weekly fluctuations in androgenic levels may be of some etiologic significance in acne even though the patient's average level remains within normal limits. This average

(22) Kenigsberg, S.; Pearson, S.; and McGavack, T. H.: Excretion of 17-ketosteroids; normal values in relation to age and sex. J. Clin. Endocrinol. 9: 426-429, May 1949.

(23) Nathanson, I. T.; Towne, L. E.; and Aub, J. C.: Normal excretion of sex hormones in childhood. Endocrinology 28: 851-865, June 1941.

percentage deviation was found to be 30 percent or less in every case. This falls within the normal range of deviation *(18, 24-26)*.

SUMMARY

The 24-hour urinary excretion of the 17-ketosteroids for each of 26 young men with acne vulgaris was determined, using the Army Medical School technic. The total number of 17-ketosteroid tests obtained was 136, each person having a test performed at weekly intervals. The average daily excretion of the 17-ketosteroids for the entire group was found to be 13.1 mg. per 24 hours. In 4 small series arranged according to age (18, 19, 20, and 22 through 24 years) the corresponding values were 10.2, 10.9, 16.5, and 18.5 mg. respectively. The average deviation of the 17-ketosteroid excretion from the mean value for each of 12 patients with acne vulgaris was determined and found to be 30 percent or less (within normal limits).

Through the application of the urinary 17-ketosteroid assay to 26 young men with acne vulgaris, no evidence was obtained to substantiate the concept that acne vulgaris is related to an excess of androgenic hormone. These 26 young men with acne vulgaris excreted quantities of 17-ketosteroids comparable to the quantities excreted by normal young men of similar age.

(24) Werner, S. C.: Daily variation in 17-ketosteroid excretion of men and women. J. Clin. Endocrinol. 1: 951-954, Dec. 1941.

(25) Drekter, I. J.; Pearson, S.; Bartczak, E.; and McGavack, T. H.: Rapid method for determination of total urinary 17-ketosteroids. J. Clin. Endocrinol. 7: 795-800, Dec. 1947.

(26) Chou, C. Y., and Wu, H.: Contents of sex hormones in normal and pathological urine. Chinese J. Physiol. 11: 429-435, May 15, 1937. Cited in footnote reference *(18)*.

BOOK REVIEWS

Rosenau Preventive Medicine and Hygiene, by *Kenneth F. Maxcy,* M. D., Dr. P. H., Professor of Epidemiology, The Johns Hopkins University, School of Hygiene and Public Health. 7th edition. 1462 pages; illustrated. Appleton-Century-Crofts, Inc., New York, N. Y., publisher, 1951. Price $14.

Sixteen years elapsed between the sixth and the new edition of this widely used text. In that time Dr. Rosenau died and the work of revising his book was given into the able hands of Dr. Maxcy. In order to reflect the changes in our knowledge and concepts in preventive medicine which have evolved in the period between the two editions, extensive revision has been necessary. As Dr. Maxcy says in his preface "Increasing attention is being given to the prevention of diseases of noninfectious etiology, to the maintenance of health in middle and old age, and to provisions made by the community for treatment and rehabilitation of the sick and of those who are physically or mentally handi-

capped." All this has been reflected in the new book without greatly increasing the size (there are slightly fewer pages but the pages are a little larger in the new edition). Except for Dr. Sebrell all of the contributors are new; the preface is new; most of the illustrations are new; and the contents have to a large extent been rearranged.

The subsection on common respiratory diseases has been expanded and includes primary atypical pneumonia; that on scarlet fever has been expanded to include hemolytic streptococcal infections; that on intestinal worms has been greatly expanded and placed with the other intestinal diseases instead of with the chapter on soil which no longer appears as such; that on infectious jaundice now appears under the two heads, infectious hepatitis and homologous serum jaundice; that on encephalitis has been enlarged to include the commonly recognized types; that on arthropod-borne diseases and their vectors has been expanded; that on the vitamin deficiencies and goiter is now incorporated in the chapter on malnutrition; that on noise and that on resuscitation have been expanded to a full chapter each; and that on industrial hygiene has also been greatly expanded.

Chapters and subchapters on sex hygiene, contraception, heredity, drug addiction, glaucoma, personal hygiene, housing, nuisance, sanitary surveys, odors, disinfection, trichophytosis as such have been dropped. Some of the material included under these headings appears under a new heading and some is not to be found. Ocular hygiene (but not glaucoma) appears under "Illumination" and maritime quarantine is mentioned under "Plague" but is not included in the index. The section on air appears rearragned under "Environmental Medicine."

There are new chapters or subchapters on airborne infection; infectious mononucleosis; bartonellosis; rickettsialpox; Q fever; leptospirosis; choriomeningitis; coccidioidomycosis; histoplasmosis; toxoplasmosis; health services for school children; services for physically handicapped children; senescence, chronic disease and disability in adults; air conditioning; radioiosotopes; epidemiology; international health organization; and voluntary health organizations.

Summaries are included at the end of some of the longer chapters and the bibliographies at the end of subchapters have been greatly expanded. Unfortunately this book will not be as easy to use as a reference as was the sixth edition because not only has the breakdown in the table of contents been drastically cut but so has the index (51 pages in the sixth and 14 pages in the new edition). An odd example of cross indexing was noted with reference to mental hygiene. Under this head the reader is referred to page 756 but under "Hygiene, mental" he is referred to page 1417. He will find the subject mentioned on both pages.

Confronted with an enormous task the editor and contributors have produced a monumental work which will surely be a standard text for many years and one which no one interested in preventive medicine can afford to be without.—*Col. W. G. Brandstadt, MC, U. S. A.*

Paranasal Sinuses: Radiographic Technic

Harold A. Vinson, *Lieutenant Colonel, MC, U. S. A.* (1)

FOR about 2 years the technic of positioning for radiographic examination of the paranasal sinuses, here described, has been used successfully in this hospital. I have found no mention of a similar technic in the literature. The method consists of taking the 4 routine views of the paranasal sinuses on a single 14 by 17 inch film instead of using a separate film for each of the 4 views.

All views are made with the patient in an upright position, using the Bucky technic, 82 K. V., 60 ma., and 30 inches between target

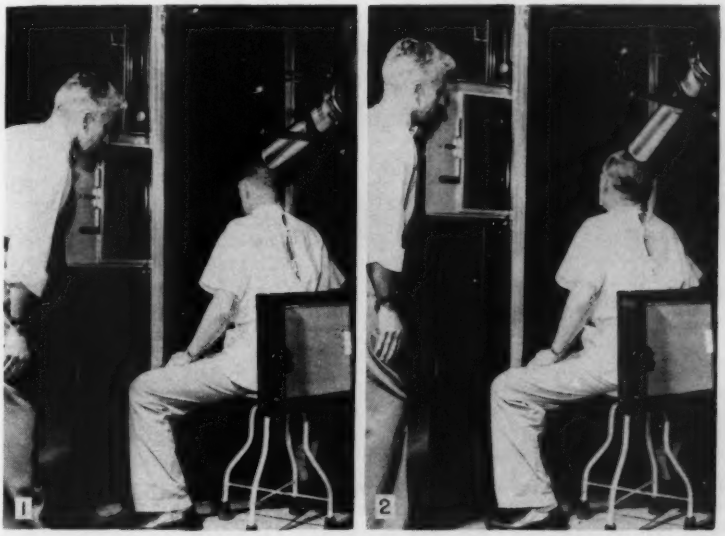

Figure 1. First view of paranasal sinuses. Cassette is only half way in to demonstrate application of R's. Figure 2. Second view of paranasal sinuses. Cassette is fully inserted on each view before exposure.

(1) U. S. Army Hospital, Fort Knox, Ky.

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and film, varying the time of exposure as follows: (1) frontal, 1 second; open-mouth, 1.5 seconds; maxillary, 1.75 seconds; and lateral, 0.4 second. An extension cone with a diameter of 4 inches is used, with the cone adjacent to the patient's head for the frontal view. The cone is kept at the same distance from the film for the 3 additional views, with a resultant increase in distance between the cone and patient's head on the lateral view. The cone limits the fields so that no other blockage of the film is necessary. An aid in centering the patient is

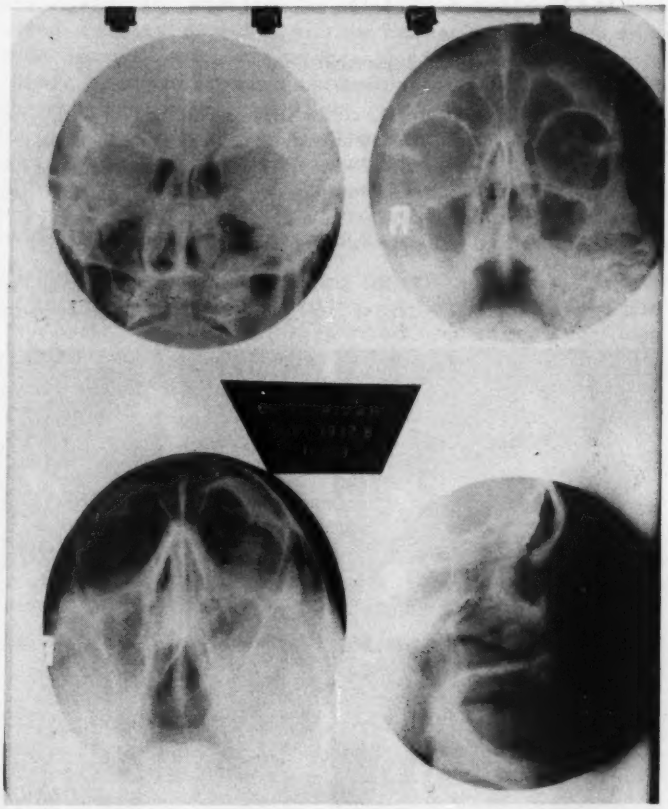

Figure 3. Routine roentgenogram of paranasal sinuses on a single 14 by 17 inch film.

to draw 2 lines on the table top, as shown in figures 1 and 2. These are drawn at the *midportion* of each half of the cassette. The R's are placed on the cassette with tape, in such a position as to be included in the fields, before the cassette is inserted in the tray. Routinely the 2 views on the right side of the film are made first, as shown in figures 1 and 2, followed by the 2 on the left. Male patients sit on a

stool, straddling the table; women and children sit on the stool with both knees on one side of the table, rotating the trunk so that the shoulders are parallel to the table surface. A portable upright Bucky diaphragm could be used just as well. Film identification is made in the center of the film by a short exposure of lead markers placed on the cassette, the remainder of the exposed film being blocked with sheet lead, as shown in figure 3.

SUMMARY

The advantages of the process described, in which 4 views of the paranasal sinuses are taken on a single 14 by 17 inch film, are that it: (1) reduces film cost, (2) eliminates time required for technician to remove and replace extra cassettes, (3) eliminates time required for darkroom technician to load and unload extra cassettes and film hangers, (4) saves clerk's time in preparing films for reading, (5) saves time in reading the film in that only one film is placed on and removed from the view box, and (6) provides one large-sized film which is easier to find than 4 small films in the conventional large-sized filing envelopes.

BOOK REVIEWS

American Pharmacy, Fundamental Principles and Practices, Pharmaceutical Preparations. Editor-in-Chief: *Rufus A. Lyman,* M. D., Dean Emeritus, College of Pharmacy, University of Arizona. Advisory Editors: *James M. Dille,* Ph. D., Professor of Pharmacology; *Noel E. Foss,* Ph. D., Dean, School of Pharmacy, University of Maryland; *Glenn L. Jenkins,* Ph. D., Dean, School of Pharmacy, Purdue University; *Rudolph A. Kuever,* Ph. D., Dean, College of Pharmacy, State University of Iowa; *Hugh C. Muldoon,* D. Sc., Dean, School of Pharmacy, Duquesne University; and *Howard C. Newton,* Pharm. D., Dean, Massachusetts College of Pharmacy. Consulting Editor: *George Urdang,* Ph. G., D. Sc. Nat., Sc. D. (H. C.), Director, American Institute of History of Pharmacy, Professor of the History of Pharmacy, University of Wisconsin, and 21 contributors. 3d edition. 505 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1951.

This work is designed for use as a textbook in pharmacy. By virtue of their close association with schools of pharmacy the authors are experienced in presenting the material in a manner conducive to assimilation by the student. The book has 2 main divisions. The first deals with fundamental principles and processes, with chapters on metrology; specific gravity and specific volume; heat and refrigeration; purification and clarification; the mechanical subdivision of drugs; solutions; colloids, emulsions, and suspensions; extraction; sterilization; and preservation and packaging. The second is devoted to pharmaceutical preparations and has chapters discussing waters; syrups and juices;

solutions, injections, and ampuls; infusions and decoctions; mucilages, creams, glycerogelatins, glycerites, and collodions; mixtures, magmas, and gels; soap and oleates; liniments, lotions, petroxolins, and sprays; ointments, cerates, plasters, and cataplasms; emulsions; suppositories; spirits and elixirs; vinegars, tinctures, fluid glycerates, and extracts; resins and oleoresins; masses, pills, troches, and tablets; powders, capsules, cachets, oil sugars, candy medication, and triturations; and effervescent salts. The physical make-up of the text is excellent for purposes of study. The paper is good, the print is clear, and the arrangement on the page makes reading easy and minimizes eye fatigue. The range of material is adequate, the arrangement is logical, and the information is well selected and well presented. The illustrations are especially good. The earlier editions have been in use in the Pharmacy Technicians School of the U. S. Naval Medical School, National Naval Medical Center, for several years and have been found very satisfactory. The new edition is a worthy successor.

—*Commander R. L. Taylor, MSC, U. S. N.*

The Psychology of Flight, by *Alex Varney.* 269 pages. D. Van Nostrand Co., Inc., New York, N. Y., publisher, 1950. Price $3.75

Written not by a psychologist, but by a veteran flight instructor, this volume explains in plain understandable language the emotional and physical factors which confront the student pilot during his training period. The author's broad experience enables him to illustrate the many situations he describes by anecdotes or parables which, though generally acceptable, in some cases seem to oversimplify the subject under discussion. The topics covered in the various chapters indicate that consultation with qualified psychologists was obtained, and this is acknowledged in the preface. Flight surgeons and other physicians associated with aviator training can safely recommend this book to flight instructors and advanced students. It does not seem entirely suitable for primary students.—*Col. R. J. Benford, U. S. A. F. (MC)*

The Structure of the Fowl, by *O. Charnock Bradley,* M. D., D. Sc., F. R. C. V. S. Revised by *Tom Grahame,* T. D., F. R. C. V. S., F. R. S. E., Professor of Anatomy, Royal (Dick) Veterinary College, Edinburgh; Lecturer on Comparative Anatomy, University of Edinburgh. 3d edition. 128 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1951.

This new edition of a well-known text is an excellent reference book that deals not only with the gross structure of the avian body but also with the histology of its tissues and organs. The book is well written, concise yet complete, and copiously illustrated. The book is divided into 13 chapters, each of which deals with a single anatomic system or set of organs. A large section deals with the embryology of the chick.

—*Lt. Col. K. H. Willers, VC, U. S. A.*

Chylous Ascites of Unknown Cause[(1)]

Leo W. Olechowski, *Commander, MC, U. S. N.*

John H. Froyd, *Lieutenant, junior grade, MC, U. S. N. R.*

THE presence of chylous fluid within the body cavities constitutes an extremely rare entity, more especially so in the absence of trauma as a cause. Jahsman *(2)* was able to find reports of only 105 patients with chylous ascites of which about 40 percent were nontraumatic in origin. Yater *(3)* estimated the total number of reported cases of nontraumatic chylothorax at less than 100. The following case demonstrates the finding of a chylous fluid within the abdominal cavity without an obvious cause.

CASE REPORT

A 22-year-old seaman entered this hospital with a history of lower abdominal pain of gradual onset which was cramping in nature at first, gradually became steady, and then localized in the right lower quadrant. The symptoms began 2 days before hospital admission. Nausea without vomiting was present from the onset of the symptoms. The patient denied respiratory or genitourinary symptoms. The stools had been normal in appearance and frequency. Trauma was denied.

Physical examination revealed a temperature of 99° F., pulse 92, respirations 18, and a blood pressure of 118/76. The patient appeared to be in moderate distress. There was slight muscle guarding of the lower abdomen, three plus tenderness in the right lower abdominal quadrant, two plus tenderness in the left lower abdominal quadrant and rebound tenderness in both lower quadrants. No scars were noted and no organs or masses were palpable. Peristalsis was normal. Rectal examination revealed minimal tenderness which was located high on the right side. The leukocyte count was 13,200 with 2 neutrophilic band cells, 91 neutrophils, 4 lymphocytes, and 3 monocytes per 100 cells.

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(1) U. S. Naval Hospital, Oakland, Calif.

(2) Jahsman, W. E.: Chylothorax; brief review of literature; report of 3 non-traumatic cases. Ann. Int. Med. 21: 669-678, Oct. 1944.

(3) Yater, W. M.: Non-traumatic chylothorax and chylopericardium; review and report of case due to carcinomatous thromboangiitis obliterans of the thoracic duct and upper great veins. Ann. Int. Med. 9: 600-616, Nov. 1935.

A tentative diagnosis of acute appendicitis was made and an exploratory laparotomy was performed. On opening the abdomen, about 900 cc. of opalescent milky fluid was found to be free within the peritoneal cavity. The appendix was found to be chronically inflamed and was removed in the usual manner. The terminal ileum was explored for a distance of 3 feet and found to be normal. A cigarette drain was inserted into the pelvis, the incision was closed, and an 8-inch right paramedian incision was made. The liver, diaphragm, gallbladder, and spleen were found to be normal. The anterior part of the stomach was infiltrated subperitoneally by a chylous substance which also invaded the stomach wall. The lesser peritoneal cavity was opened. The posterior part of the stomach was normal except for an area of dimpling which appeared to be the scar of a healed ulcer which had previously perforated. The pancreas was normal. On the right side the chylous fluid was not only under the visceral and parietal peritoneum, but invaded the walls of the colon giving it a milky appearance. Oozing of this substance was noted through all layers of the peritoneum. The left side of the peritoneal cavity was relatively normal and examination of the mesentery revealed only the presence of chylous fluid between the mesenteric folds of some areas. A second cigarette drain was inserted through a right flank stab wound; 600,000 units of penicillin and 1 gram of streptomycin were instilled into the abdominal cavity. The wound was then closed.

The patient's course was uneventful. Slight drainage of chylous sanguineous material was seen issuing from the drains for the first 24 hours. The drainage thereafter rapidly decreased and finally subsided. The wounds healed and the patient's temperature was normal. The patient was ambulatory by the eighth postoperative day.

Examination of the chylous fluid revealed the following: Total cholesterol, 123 mg. per 100 cc.; amylase, 34 mg. per 100 cc.; lipid phosphorus, 2.71 mg. per 100 cc.; and several fat globules per drop of fluid were found by staining with Sudan III. The patient's blood nonprotein nitrogen on the same day was reported as 34.3 mg. per 100 cc., with a total protein of 6.8 grams per 100 cc. of which 5.3 grams were albumin and 1.5 grams globulin. The blood total chlorides were 580 mg. per 100 cc. A leukocyte count on the first postoperative day was 18,850 with 11 band forms, 67 neutrophils, and 22 lymphocytes per 100 cells. A red blood cell count on the same day was 5,030,000 and a hemoglobin determination was 14.5 grams per 100 cc. A roentgenogram of the chest was reported as showing no significant abnormality of the heart, lung fields, or other structures.

A follow-up laboratory examination on the thirteenth postoperative day revealed a total serum protein of 7.3 grams per 100 cc., of which 5.1 grams were albumin and 2.2 grams globulin. A culture of the chylous fluid was reported to have an abundant growth of anaerobic gram-positive staphylococci. The blood Kahn test was negative. The excised

appendix was reported to show fibrous obliteration of the submucosa, mucosa, and lumen and a submucosal neuroma was present. The patient was discharged on the twenty-fifth postoperative day.

DISCUSSION

The detection of true chyle in the peritoneal cavity is often difficult and although it is admittedly open to some question in the case reported, the low cholesterol and lipid phosphorus is definitely consistent with such a finding *(4)*. Furthermore, the presence of large numbers of fat globules in an opalescent, odorless, milky fluid is believed to establish that the fluid is chyle *(5, 6)*. The origin of the chylous material in this case can only be guessed. The largest single cause of chylothorax and chyloperitoneum is traumatic rupture of the thoracic duct *(5)*. MacNab and Scarlett *(7)* classify the causes of trauma to the duct as follows:

1. External violence (closed trauma; trauma with fractured ribs, clavicles, or vertebras; gunshot wounds; and stab wounds).

2. Operative wounds with complete duct severance or section of one or more terminals.

The most common cause of nontraumatic chylothorax is malignancy, either by obstruction of the thoracic duct or by multiple metastases to the lymphatic system *(3, 6, 8)*. It is difficult, however, to reconcile the concept of obstruction as the cause of chylothorax and chylous ascites with that of Lee *(9)* who, after ligation of the thoracic duct in mice, demonstrated that this duct was not essential for life in these animals and that neither type of chylous effusion occurred. Ehrenhaft and Meyers *(10)* reported a case of inadvertent ligation of the supradiaphragmatic portion of the thoracic duct and noted that ligation was better tolerated than section of the duct. The possibility of producing chylous ascites by lymph node compression of the lesser and collateral lymph channels and the main thoracic duct has not been excluded by Lee's experiments. Chylous ascites is also listed by Christopher *(8)*

(4) Everett, M. R.: Medical Biochemistry. 2nd edition. Paul B. Hoeber, Inc., New York, N. Y., 1946. pp. 214-216.

(5) Griffith, R. L.: Chylous ascites and chylothorax. Northwest Med. 47: 800-803, Nov. 1948.

(6) Pratt, J. H. (Rochester, Minn.), and McCready, F. J.: Multiple polyps, multiple intussusceptions and chylous ascites; report of unusual case. S. Clin. North America 29: 1209-1213, Aug. 1949.

(7) MacNab, D. S., and Scarlett, E. P.: Traumatic chylothorax due to intrathoracic rupture of thoracic duct. Canad. M. A. J. 27: 29-36, July 1932. Quoted by Bauersfeld, E. H.: Traumatic chylothorax from ruptured thoracic duct treated by intravenous injection of aspirated chyle. J. A. M. A. 109: 16-18, July 3, 1937.

(8) Christopher, F. (editor): A Textbook of Surgery. 3d edition. W. B. Saunders Co., Philadelphia, Pa., 1944. pp. 237-238.

(9) Lee, F. C.: Establishment of collateral circulation following ligation of the thoracic duct. Bull. Johns Hopkins Hosp. 33: 21-31, Jan. 1922.

(10) Ehrenhaft, J. L., and Meyers, R.: Blood fat levels following supradiaphragmatic ligation of thoracic duct. Ann. Surg. 128: 38-45, July 1948.

and Thorek *(11)* as a frequent accompaniment of congenital or secondary lymphangiectasis. Both authors noted that the development of ascites is slow.

Rupture of a cavernous lymphangioma or cyst of the mesentery has been mentioned by some as a cause of chylous fluid within the abdominal cavity *(8, 12, 13)*. The absence of roentgenologic evidence of intrathoracic fluid supports this opinion in explanation of our case. Chylous ascites is generally found in conjunction with chylothorax, except when the cause is limited to the abdomen *(6)*. Yater *(3)* stated that chylous ascites was present in one-half of the cases of chylothorax reviewed by him.

According to Moore *(14)*, the commonest cyst of the mesentery is a lymphatic cyst resulting from an anomalous development or obstruction of the lymphatic vessels. Cysts derived from the wolffian duct and from partial duplication of the intestine and true dermoid or teratomatous cysts are less frequently seen. Peterson *(15)* included chylous (as well as serous, sanguineous, and dermoid) cysts in his classification of cysts arising from embryonic remnants and sequestrated tissue. He did not mention lymphatic obstruction. In Benedict's report of 96 cases of mesenteric cyst, no definite age incidence was found, with the sex distribution being equal *(16)*. Warfield *(12)* reported a maximum incidence in the fourth decade of life, with women developing the lesion twice as often as men. Thorek *(17)* stated that mesenteric cysts usually have as their only symptom a slowly enlarging painless abdomen, but that severe abdominal pain with vomiting may occur. Warfield *(12)* and Beahrs and Judd *(13)* indicated that rupture of a mesenteric cyst may simulate an acute abdominal condition. The most common condition produced is an acute mechanical obstruction caused by volvulus, angulation of the bowel, adhesions, intussusception, stenosis of the bowel, or pressure *(13)*. Friend *(18)* reported 52 true chylous cysts without any mention of rupture. Alesen *(19)* reported a cyst in a 5-year-old boy which simulated acute appendicitis. The cyst was unruptured. The amount of fluid seen in our patient is not unusual in unruptured

(11) Thorek, M.: Modern Surgical Technic. 2nd edition. J. B. Lippincott Co., Philadelphia, Pa., 1949. p. 929.

(12) Warfield, J. O., Jr.: Study of mesenteric cysts, with report of 2 recent cases. Ann. Surg. 96: 329-339, Sept. 1932.

(13) Beahrs, O. H., and Judd, E. S., Jr.: Chylangiomas of the abdomen; report of case. Proc. Staff Meet., Mayo Clin. 22: 297-304, July 23, 1947.

(14) Moore, R. A.: A Textbook of Pathology. W. B. Saunders Co., Philadelphia, Pa., 1944. p. 852.

(15) Peterson, E. W.: Cysts of mesentery. Ann. Surg. 112: 80-86, July 1940.

(16) Benedict, A. L.: Bibliography of chylous cysts of mesentery. Surg., Gynec. & Obst. 606-610, June 1913.

(17) See reference footnote *(11)*, pp. 2073-2074.

(18) Friend, E.: Mesenteric chyle cysts. Surg., Gynec. & Obst. 15: 1-6, July 1912.

(19) Alesen, L. A.: Mesenteric chylous cysts; report of case. California & West. Med. 30: 261-262, Apr. 1929.

cysts. Wilson *(20)* reported a cyst containing more than 2,000 cc. of fluid in an 8-year-old child and Lamb *(21)* described one containing 1,000 cc. of fluid which caused an intestinal obstruction by pressure in a 5-year-old child.

The absence of evidence of chylothorax in our patient, the lack of other pathologic findings within the abdominal cavity, and the uneventful convalescence suggest the possibility of leakage from, or rupture of, a mesenteric cyst. The subsequent collapse of the walls may have presented an appearance resembling the mesentery proper. The presence of the chylous fluid beneath the peritoneum also supports this idea.

The prognosis of chylous ascites resulting from trauma or section of the thoracic duct is uncertain. Jahsman *(2)* reported a 50 percent mortality in patients with chylothorax from the continued loss of fluid rich in protein (up to 4 percent *(20, 22)*) which leads to rapid dehydration and malnutrition. The prognosis in chylous ascites secondary to other lesions is that of the underlying disease modified by the ascites. The prognosis of mesenteric cysts likewise is extremely variable, depending largely on the size and location of the cyst, the type of disturbance created by its presence, and the technical nature of the surgical procedures necessary to effect relief.

The treatment of a ruptured cyst is not discussed in the literature reviewed, although the procedures of removal recommended are dissection with or without segmental resection and/or enterostomy or marsupialization *(12, 16)*. The therapy of chylous ascites secondary to carcinoma is basically that of the underlying disease. Surgical attempts to locate and repair a tear of the duct in traumatic chylothorax and chylous ascites are usually unsuccessful *(5)*. Griffith *(5)* advised supportive measures with a high protein diet and fluid replacement therapy. Bauersfeld *(22)* and Jahsman *(2)* reported rather dramatic success by intravenous replacement of fluid obtained by thoracentesis. Whitcomb and Scoville *(23)* reported a case of anaphylaxis with this procedure. Heppner *(24)* indicated oral feeding of the chyle obtained by paracentesis may be of aid.

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(20) Wilson, G. I.: Chylous mesenteric cyst. Brit. M. J. 1: 102-103, Jan. 19, 1929.
(21) Lamb, E. J.: Mesenteric chylous cyst; report of case. California & West. Med. 31: 139, Aug. 1929.
(22) Bauersfeld, E. H.: Traumatic chylothorax from ruptured thoracic duct treated by intravenous injection of aspirated chyle. J. A. M. A. 109: 16-18, July 3, 1937.
(23) Whitcomb, B. B., and Scoville, W. B.: Methods of marking plane of section in open lobotomy operation. Radiology 54: 741-742, May 1950.
(24) Heppner, G. J.: Bilateral chylothorax and chyloperitoneum. J. A. M. A. 102: 1294, Apr. 21, 1934.

SUMMARY

A case which showed free and subperitoneal fluid consistent with chyle and which simulated an acute abdominal emergency is presented. The chylous peritoneal effusion was without obvious cause. A chylous mesenteric cyst may have produced the findings.

BOOK REVIEWS

Syphilis, by *Richard S. Weiss,* M. D., Professor Emeritus of Clinical Dermatology, School of Medicine, Washington University; Dermatologist-in-Chief, The Barnard Free Skin and Cancer Hospital, St. Louis; and *Herbert L. Joseph,* M. D., Consultant in Dermatology and Syphilology, U. S. Air Force Base, Travis Air Force Base, Calif.; Instructor, Department of Medicine, Division of Dermatology, Stanford University School of Medicine, San Francisco. 180 pages; illustrated. Thomas Nelson & Sons, New York, N. Y. publishers, 1951. Price $5.

The object of this book is to provide a brief but comprehensive text for the general practitioner, the medical officer, and the student. In order to be useful to the medical officer it should provide a concise source of authoritative information on diagnosis, treatment, and post-treatment evaluation. We are, however, offered no criteria for the diagnosis of latent syphilis, no single integrated regimen of therapy for syphilis in its various phases, no schedule of follow-up examinations, and no criteria for determining relapse or clinical cure. The clinical discussions are clearly written and the photographs are excellent. Grammatical errors and contradictions are noted throughout the text. This book cannot be recommended as a guide for the medical officer.

—*Lt. (jg) J. F. Morrill, MC, U. S. N.*

Roentgen Anatomy, by *David Steel,* M. D., St. John's Hospital and Evangelical Deaconess Hospital, Cleveland, Ohio. 54 plates. Charles C Thomas, Publisher, Springfield, Ill., 1951.

This volume is a good reference in roentgen anatomy. The diagrams accompanying the roentgenograms are adequately labeled and include all structures of the bony skeleton. To make this work complete, a normal bronchogram, pneumoencephalogram, pyelogram, cardiogram, cerebral angiogram, and gastrointestinal series should be added. In its present form, however, it should prove of value to students and the average roentgenologist.—*Commander M. W. Mason, MC, U. S. N.*

Salicylate Intoxication in Children[1]

Arthur C. Dietrick, *Captain, MC, U. S. A.*
Harold L. Guard, *Major, MC, U. S. A.*
Leo J. Geppert, *Lieutenant Colonel, MC, U. S. A.*

PHYSICIANS who seldom treat infants are usually careful when using major drugs but are apt not to use due caution when prescribing medication such as aspirin which they consider innocuous. The death of a child from an overdose of aspirin stimulated the preparation of this report. Although salicylate idiosyncrasy does occur (2) salicylate poisoning in pediatric practice is usually caused by improper dosage in the infant less than 1 year of age and by accidental ingestion in the "toddling" age group.

Six cases of salicylism were diagnosed on the pediatric service of this hospital between March 1947 and February 1951. The ages ranged from 3 months to 3 years. Three cases were caused therapeutically by medication prescribed by physicians for infants between 3 and 6 months of age. The other three patients, aged 2 to 3 years, accidentally ingested salicylates. During the period from 1933 to 1943, about 52 fatal cases of salicylism were reported to the United States Census Bureau each year. Slightly over half of these patients were less than 4 years of age. Only a fraction of the cases are reported because this diagnosis is easily missed by both clinician and pathologist. The following cases illustrate the problems encountered.

CASE REPORTS

Case 1. On 26 February 1947 a 3-month-old boy developed a "cold" characterized by nasal discharge, cough, fever, and anorexia. Four days later about 0.3 gm. of aspirin every 4 hours, was prescribed by a physician. The baby was hospitalized the following day at an adjacent station hospital. Physical examination at that time revealed a temperature of 105° F., restlessness, rapid labored respirations, and abdominal distention. His condition became worse with cyanosis and brachypnea, and he was transferred to this hospital on 4 March.

(1) Brooke Army Hospital, Fort Sam Houston, Tex.
(2) Gross, M., and Greenberg, L. A.: Salicylates. Hillhouse Press, New Haven, Conn.,1948. p. 128.

Physical examination revealed a well-developed, moderately dehydrated infant who appeared seriously ill. He weighed 5 kg. Lateral nystagmus was noted. His gag reflex was absent and excess mucus was present in the oral pharynx. His left tympanic membrane was slightly hyperemic. There was mild inspiratory substernal retraction. The respiratory rate was 44. Moist rales were heard over the right upper anterior portion of the chest. The abdomen was moderately distended and tympanitic. Peristaltic sounds were not heard.

Immediate treatment consisted of oxygen inhalations; sixth molar sodium lactate solution, and 2.5 percent dextrose in saline solution parenterally; penicillin; and gastric lavage. The material obtained by lavage was dark red and black. About 12 hours after admission his condition was critical. He was comatose and there were generalized convulsive twitchings. His temperature was 104° F. and his skin was ashen. His neck was flaccid and the anterior fontanel was depressed.

His leukocyte count was 13,000 with 65 percent polymorphonuclear cells and 28 percent lymphocytes; hemoglobin was 70 percent; clotting time was 1½ minutes; prothrombin time was 55 seconds; carbon dioxide combining power was 39 volumes per 100 cc.; blood urea nitrogen was 29 mg. per 100 cc. A "bloody" spinal tap revealed 10 leukocytes (6 polymorphonuclear cells and 4 lymphocytes); 44.8 mg. of sugar per 100 cc.; and 64.5 mg. of protein per 100 cc. The blood salicylate level was 42 mg. per 100 cc. A roentgenogram of the chest was normal.

Further therapy consisted of continuous parenteral fluids, blood transfusions, parenteral vitamin K (a total of 25 mg.), and 100 mg. of ascorbic acid daily. The fever was controlled with the application of cool moist towels and the convulsions by phenobarbital sodium. The patient became afebrile and responsive on the following day, crying and taking glucose and water by mouth. There were no further convulsions. At this time the carbon dioxide combining power was 45 volumes per 100 cc.; the prothrombin time was 7 seconds; and the blood urea nitrogen was 16 mg. per 100 cc. The urine was negative for salicylates on the fourth hospital day. Stools obtained by daily enemas were tarry until 8 March. The abdominal distention subsided gradually with the use of enemas, rectal tubes, and prostigmine parenterally. He was discharged cured on the seventh hospital day.

Case 2. A 5-month-old boy developed an upper respiratory infection on 5 August 1948. On 9 August he was seen by a civilian physician who diagnosed tonsillitis and prescribed penicillin nose drops, 4 cc. of liquid sulfadiazine every 4 hours, and powders, each containing 0.2 gram of codeine and 2.36 grams of empirin compound (1.22 gram of aspirin). This error in dosage came about because the physician did not write his prescription plainly and the pharmacist made up 12 papers each containing the total amount intended for 12 doses. The parent was instructed to give 1 powder p. r. n. for fever. At noon on 11 August the infant was given 4 cc. of liquid sulfadiazine and

1 powder. By 1300 hours he was drowsy and although could not be awakened, the parent gave him these medicines every 4 hours for 4 more doses. He was admitted to this hospital on 12 August because of extreme drowsiness.

On physical examination the patient was stuporous and the pupils were pinpoint with only slight reaction to light. His respirations were deep; the rate was 28. His temperature was 101° F. He weighed 6 kg.

Lumbar puncture and a roentgenogram of the chest were negative. The leukocyte count was 15,000 with 51 percent polymorphonuclear cells and 41 lymphocytes. The urine was positive for salicylates through the second hospital day. Fluids were forced orally with no emesis. Penicillin was administered parenterally. The patient was afebrile on the third hospital day and made an uneventful recovery.

Case 3. A 5-month-old girl developed fever and cough on 8 July 1948. She was examined by a pediatrician who made no specific diagnosis but advised penicillin every 3 hours. Further medication consisted of 4 cc. of elixir of benadryl q. i. d., given for an undetermined time during and preceding the illness. On the night of 13 July and the morning of 14 July, the baby refused food and fluids, and vomited those administered; in addition, she began to have rapid deep respirations.

She was admitted to this hospital that same morning, where she was found to be semicomatose, moderately dehydrated, and acidotic. Her temperature was 101.5° F.; her respiratory rate was 45; and her pulse was 86. She weighed 6.5 kg. She had a heavy, frothy, purulent nasal discharge and postnasal drip. Her respirations were of the Kussmaul type; her breath sounds were roughened with occasional moist rales at both apices; her heart tones were rapid and faint; and her abdomen was distended. Opisthotonos was evident. The impression on admission was dehydration and acidosis and probable developing laryngotracheobronchitis.

A lumbar puncture was negative. Her carbon dioxide combining power was 36 volumes per 100 cc. Seventy-five cubic centimeters of sixth molar sodium lactate solution were given subcutaneously. One and one-half hours after admission her respirations became obstructive in type with dyspnea and retraction of the interspaces, and the thick, frothy, purulent secretion became abundant in the nose and mouth. An emergency roentgenogram of the chest was negative. Her leukocyte count was 15,700 with 40 percent neutrophils and 60 percent lymphocytes. She was given 20,000 units of diphtheria antitoxin intramuscularly; oxygen inhalations; 60 mg. of aminophylline every 4 hours; 15,000 units of penicillin every 3 hours; 4 cc. of a 5 percent solution of sodium sulfadiazine every 6 hours; 0.75 cc. of coramine; and 350 cc. of sixth molar sodium lactate solution.

On the second hospital day following the giving of fluids intravenously the thick secretions subsided; respirations became shallow

and marked abdominal distention developed. The fontanel was depressed, the lips were cherry red, and the lungs were clear. Adrenal cortical extract was administered and fluids were given intravenously. A slight increase in responsiveness was noticed. Because no spontaneous urination occurred, catheterization was performed and 150 cc. of urine obtained. A roentgenogram of the chest and an abdominal paracentesis were negative. Her leukocyte count was 37,650. Urinalysis showed a trace of sugar and 1 plus albumin. On further questioning of the father, it was found that in addition to previously mentioned treatment the infant had been given 0.13 gram of aspirin every 4 hours for 3 days preceding admission. The father had not considered this important enough to mention when asked about medication. A urinary salicylate level of 19 mg. per 100 cc. and a blood salicylate level of 86 mg. per 100 cc. were reported 48 hours after admission. Prostigmine was given for the abdominal distention without relief. Emesis of coffee-groundlike material occurred during the night. A blood transfusion was administered.

On the third hospital day there was an episode of apnea at noon, which responded to oxygen, artificial respiration, and coramine. Generalized edema developed and the intravenous administration of fluids was discontinued for 3 hours. Her temperature was 103.4° F. at 2000 hours. On the fourth hospital day the patient was anuric and the edema increased. Parenteral fluids, Wangensteen suction, and supportive therapy were continued, but her clinical course was steadily downhill. On the fifth hospital day her condition was the same. Her nonprotein nitrogen was 53 mg. per 100 cc. and her carbon dioxide combining power was 57 volumes per 100 cc. Her extremities became rigid and cyanosis was present despite continuous oxygen inhalations. Her respirations were slow and diffuse bilateral ronchi were present in the chest. Intravenous fluids and blood were continued, but cyanosis gradually increased and her respirations became progressively slower and more shallow, finally ceasing at 1510 hours on 18 July.

At autopsy moderate dilatation of the stomach, terminal ileum, and descending colon and injection and edema of the gastric mucosa were seen. Microscopic examination revealed marked dilatation and congestion of the pulmonary vessels including the alveolar capillaries of the lower lobes of both lungs. The muscle fibers of the heart were slightly swollen and fragmented; the interstitial spaces were slightly broadened and showed scattered round cells. The liver, adrenals, and kidney were moderately congested and the liver showed fatty metamorphosis. The blood vessels of the brain showed dilatation and prominent perivascular spaces.

Case 4. A 27-month-old girl was seen at the Children's Clinic on 15 June with history of accidental ingestion of an unknown quantity of aspirin at some time during the previous night. The clinical condition was good. The only abnormality present was mild dyspnea. The

blood salicylate level was 30 mg. per 100 cc.; the carbon dioxide combining power was 26 volumes per 100 cc. Because the child was apparently well at least 12 hours after ingestion of the tablets, she was not hospitalized and made an uneventful recovery at home.

Case 5. A 2½-year-old boy was admitted to this hospital on 4 September 1949. On the day prior to admission he accidentally ingested an unknown number of 0.3 gram aspirin tablets. Emesis developed and he was examined by a physician the same night, but he was sent home because his clinical condition seemed satisfactory. Emesis persisted and when hyperpnea ensued he was admitted to the hospital. His temperature was 102° F.; pulse was 120; respirations were of the Kussmaul type; and he was mildly irritable.

His carbon dioxide combining power on admission was 20 volumes per 100 cc. The urinary salicylates were 60 mg. per 100 cc. The pH of the blood was 7.35 and the blood salicylates were 68.4 mg. per 100 cc. Sixth molar sodium lactate solution and 5 percent dextrose solution were administered parenterally. Oral intake was resumed on the second hospital day. The carbon dioxide combining power was 60 volumes per 100 cc. and the blood salicylate level was 35.4 mg. per 100 cc. The urinary salicylates were 253.9 mg. per 100 cc. The prothrombin time was normal. On the third hospital day parenteral fluids were discontinued. The oral intake was adequate. The urinary salicylates were 92 mg. per 100 cc. and the pH was 6.8. On the fourth hospital day the patient was clinically well. His urinary salicylates were reported as a trace and the pH as 9. He was discharged cured on 19 September.

Case 6. A 3-year-old boy was admitted to this hospital at 1130 hours on 7 February 1951, following the accidental ingestion of 14 APC tablets (each containing 0.26 gram of aspirin, 0.16 gram of phenacetin, and 16 mg. of caffeine) at 1900 hours the day before. At 2000 hours a parent gave the patient an enema as he complained of a stomach-ache. He vomited at 2230 hours and 6 more times prior to admission. There was no hematemesis. He refused all food following ingestion of the tablets. On the morning of admission he was drowsy and could be awakened only by vigorous external stimuli. On admission his temperature was normal; his pulse was 140; and his blood pressure was 94/60. He weighed 16 kg. Generalized flaccidity was present and he was semiconscious. There was no response to pain, and his breathing was of the Kussmaul type. There was a strong acetone odor to his breath. An upper respiratory infection was present. Neurologic examination was negative except for mild diminution in the deep tendon reflexes.

A clysis of glucose in saline solution was started on admission, prior to laboratory reports. The carbon dioxide combining power was 33 volumes per 100 cc.; the blood sugar was 73 mg. per 100 cc.; the blood pH was 7.2; the blood salicylates were 49 mg. per 100 cc.

The leukocyte count was 16,850, with 80 neutrophils and 19 lymphocytes. The hemoglobin was 12.5 grams. The urine was positive for sugar and acetone. The prothrombin time was 25 seconds (control 17 seconds). Twelve hours after admission the patient was afebrile and the oral intake was adequate. On the second hospital day the carbon dioxide combining power was 44 volumes per 100 cc.; the urinary salicylates were 29.7 mg. per 100 cc.; the blood salicylates were 17.8 mg. per 100 cc.; and the blood pH was 7.54. The spinal fluid was normal and negative for salicylates. Parenteral fluids were discontinued after 24 hours and the patient was alert with normal sensorium. On the third hospital day the blood and urine were negative for salicylates. The blood pH was 7.55. The urine was negative for acetone and diacetic acid. On the fifth hospital day the carbon dioxide combining power was 44 volumes per 100 cc.; the blood sugar was 82 mg. per 100 cc.; the blood urea nitrogen was 15 mg. per 100 cc.; and the blood was negative for salicylates. On that day the child was discharged from the hospital.

DISCUSSION

A history of salicylate ingestion is the best clue for the diagnosis of salicylate intoxication. Unfortunately this information is often not obtained. Accidental ingestion, unless observed directly by an adult, may not be suspected. Salicylates are given so freely by parents, and even physicians, that unless questions are direct, no mention of its use may be made. In the fatal case reported here a history of aspirin administration was not obtained until after the diagnosis had been made. Hyperventilation in an infant or child who is not seriously dehydrated, and whose history reveals none of the usual causes of acidosis, suggests salicylate intoxication (3). In any obscure illness salicylate poisoning should be considered.

The principal presenting symptoms may include mild dehydration, vomiting, stupor with periods of irritability, generalized convulsions or twitching, cyanosis, abnormal respiration as to rate or depth, acetone odor of the breath, abdominal pain, fever, thirst, polyuria, a hemorrhagic tendency, and, in older children, tinnitus. The cases described here are summarized in table 1, which shows the variability of the presenting complaints, and that no "typical" syndrome can be anticipated in salicylate poisoning. The only symptom common to all of our cases was abnormal respiration.

The diagnosis of salicylism must therefore usually be made by laboratory examination, both direct and indirect. Direct examination of the blood and urine for salicylates proves that the drug has been ingested. This may be made simply when laboratory facilities are not available by using the ferric chloride or ferric nitrate tests for the

(3) Barnett, H. L.; Powers, J. R.; Benward, J. H.; and Hartmann, A. F.: Salicylate intoxication in infants and children. J. Pediat. 21: 214-223, Aug. 1942.

qualitative demonstration of salicylate in urine, spinal fluid, or blood serum. Blood salicylate levels of less than 40 mg. per 100 cc. which are well tolerated by adults or older children may produce acute intoxication in infants. Experimental work on the absorption of salicylates tabulated by Gross and Greenberg *(4)* indicate its appearance in the blood about 10 minutes after ingestion and in the urine in about 20 minutes. The average time required to reach the maximum blood level is about 1 hour after oral ingestion, but with variations up to 12 hours reported by different investigators. Urine and blood are negative for salicylate about 48 hours following a single oral dose. Dubow and Solomon *(5)* found that a dose of 0.1 gram per kg. of body weight resulted in a blood level of from 19 to 21 grams per 100 cc. and the blood level was approximately doubled with a dosage of 0.125 grams per kg.

TABLE 1. *Symptoms and signs on admission*

	Mode of poisoning					
	Therapeutic			Accidental		
Case	1	2	3	4	5	6
Age in months	3	5	5	27	30	36
Pyrexia	+	+	+	−	+	−
Acetone breath	−	−	−	−	−	+
Abnormal respiration	+	+	+	+	+	+
Irritability or convulsions	+	−	−	−	+	−
Depression or coma	−	+	+	−	−	+
Emesis	−	−	+	−	+	+
Dehydration	+	−	+	−	−	−
Cyanosis	+	−	−	−	−	−
Abdominal pain or distention	+	−	+	−	−	+
Hemorrhagic tendency	?	−	−	−	−	−
Thirst	−	−	−	−	−	−
Polyuria	−	−	−	−	−	−

Once the presence of salicylate in the blood, urine, or spinal fluid has been proved, evidence of intoxication should be obtained. Changes in the acid-base balance are among those first noted. These have been summarized by Lipman, Krasnoff, and Schless *(6)* as follows:

Phase 1. Hyperpnea resulting from the stimulatory effect of salicylate on the respiratory center causes a decrease in the blood CO_2 concentration, altering the ratio of H_2CO_3 to a bicarbonate in the direction of increased alkalinity. Respiratory alkalosis results. Compensation is rapidly brought about by the excretion of excess bicarbonate in the urine. At this stage the urinary pH is alkaline.

(4) See reference footnote *(2)* p. 20.

(5) Dubow, E., and Solomon, N. H.: Salicylate tolerance and toxicity in children. Pediatrics 1: 495-503, Apr. 1948.

(6) Lipman, B. L.; Krasnoff, S. O.; and Schless, R. A.: Acute acetylsalicylic acid intoxication; report of 5 cases with 2 deaths. Am J. Dis. Child. 78: 477-483, Oct. 1949.

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Phase 2. The next stage of intoxication is that of compensated acidosis. Salicylates interfere with carbohydrate metabolism and ketosis results. The alkaline reserve having already been lowered in the first phase, compensation is now maintained by the renal and blood buffer systems and insofar as possible by the respiratory defense of the pH (hyperpnea).

Phase 3. The final phase is that of decompensated acidosis with depletion of the alkaline reserve, decrease in the blood pH, and failure of the respiratory and renal buffering mechanisms in their attempt to achieve compensation.

Moderate as well as large doses of sodium salicylate regularly induce hypoprothrombinemia, which may regress spontaneously to some extent as treatment continues (7). This is most marked on the second to fifth day becoming normal however, by the eleventh day. Inadequate vitamin K intake, secondary to anorexia is probably also a contributing factor (8). The literature suggests that hypoprothrombinemia, although not the only cause, may be a contributing factor in the hemorrhages observed when salicylates have been given in large and repeated doses. Hemorrhagic manifestations occur in about one-fifth of nonallergic cases of salicylate poisoning (9).

Excluding idiosyncrasy, the amount of salicylates ingested and concommitant blood levels which are observed to cause clinical symptoms of poisoning show extremely wide variation from patient to patient. The uncertainty as to the lethal dose is reflected in amounts cited, particularly in textbooks on toxicology. Opinions varying from 3 to 30 grams, depending on the type of salicylate taken (2). The customary therapeutic dose of salicylates is 60 mg. per year of age every 4 hours, or about 40 mg. per kg. of body weight per day. Symptoms of intoxication usually ensue within 24 hours with from 2 to 4 times the above doses. Whereas about 1 gram per kg. was ingested by case 2 without marked toxicity, 0.35 gram per kg. was lethal in our one fatal case (case 3). Therefore, factors other than the amount ingested influence the occurrence of symptoms. A well child who accidentally ingests a relatively large amount of salicylates may not be as severely poisoned as a child receiving smaller amounts as an antipyretic during the course of a febrile illness. The explanation for this may be depletion of the glycogen reserve accompanying the original febrile illness accentuated by the increased metabolic rate and the loss of the normal stabilizing function of the liver in carbohydrate metabolism resulting from salicylate administration (10) Table 2 summarizes the pertinent

(7) Fashena, G. J., and Walker, J. N.: Salicylate intoxication; studies on effects of sodium salicylate on prothrombin time and alkali reserve. Am. J. Dis. Child. 68: 369-375, Dec. 1944.

(8) Govan, C. D., Jr.: Effect of salicylate administration on prothrombin time. J. Pediat. 29: 629-636, Nov. 1946.

(9) See reference footnote (2). p. 116.

(10) Dodd, K.; Minot, A. S.; and Arena, J. M.: Salicylate poisoning: explanation of more serious manifestations. Am. J. Dis. Child. 53: 1435-1446, June 1937.

data from our cases and illustrates these mechanisms of salicylate intoxication.

TABLE 2. *Summary of pertinent data on 6 patients with salicylate poisoning*

	Mode of poisoning					
	Therapeutic			Accidental		
Case	1	2	3	4	5	6
Age in months	3	5	5	27	30	36
Weight in kilograms	5	6	6.5	11	12	16
Total amount of salicylate ingested (grams)	2.0	6.3	2.3	?	?	3.6
Salicylate ingested in grams per kg. of body weight	0.40	1.05	0.35	–	–	0.22
Initial blood level of salicylate (mg. per 100 cc.)	42	–	86	30	60	49
Phase of poisoning on admission	2	–	3	2	2	2
Prothrombin time on admission (control 17 seconds)	55	–	–	–	17	25
Number of hospital days urine was positive for salicylate	3	2	–	–	4	2

Profound salicylate intoxication is one of the most refractory conditions which is met in everyday practice. Better to initiate and maintain appropriate therapy, the effects of salicylates on the body and the ensuing secondary complications must be recognized as they arise. Early treatment includes gastric lavage with tap water before hyperpnea ensues. Parenteral dextrose should be started in the early phases to maintain fluid balance and to combat hypoglycemia and ketosis *(11)*. The metabolic acidosis of the second and third stages of salicylate intoxication tends to be fixed and difficult to correct. The choice of salt solution varies with individual patients *(12)*. The administration of vitamins K and C, oxygen, blood, and plasma are useful adjuncts to therapy. Lumbar puncture and sedation may be necessary to combat fever and convulsions. Any pre-existing infection must not be disregarded, but caution should be used in prescribing any medicaments possibly toxic to an already potentially damaged renal system. As is illustrated by case 3, salicylate intoxication may be irreversible even though known physiologic aberrations are corrected, probably because of enzyme poisoning *(11)*.

(11) Hartmann, A. F.: Symposium on rheumatic fever; acute salicylate poisoning. J. Pediat. 26: 214-215, Mar. 1945.

(12) Spector, S., and McKhann, C. F.: Respiratory acidosis and alkalosis in children. J. Pediat. 32: 227-245, Mar. 1948.

CONCLUSIONS

Salicylate intoxication is easily missed by both clinician and pathologist unless a strong index of suspicion as to its possible presence is maintained. Because salicylate intoxication in infancy is usually the result of prescribed medication, physicians are warned to be cautious when prescribing salicylates for this age group.

BOOK REVIEW

A Citizen's Handbook of Sexual Abnormalities and The Mental Hygiene Approach to Their Prevention, A Report of the Governor's Study Commission on Sex Deviates, by *Samuel W. Hartwell,* M. D., Assistant Director of the Michigan Department of Mental Health; Member of the Governor's Study Commission on Sex Deviates. 70 pages. Public Affairs Press, Washington, D. C., publisher, 1951. Price $1.

This pamphlet on a vital subject is well written and timely. It is based on the findings of the Governor's Study Commission on the Deviated Criminal Sex Offender of the State of Michigan. The Commission was made up of committees on (1) resources and present practices, (2) fact finding, (3) legislation, (4) education, and (5) moral and spiritual values. The subject is presented in popular style for wide distribution among thinking but nonprofessional citizens. It gives every indication that the people of Michigan are anxious to deal with an old and universal problem without hysteria or preconceived ideas and have made encouraging steps in the direction of its solution. The author has wisely devoted the greater part of this booklet to the mental hygiene of sex stressing the normal psychosexual development of the child and avoiding sensationalism. Disputed questions are discussed and prevalent but fallacious ideas are exposed to the light of current knowledge. The final section is devoted to the practical but difficult measures which show the greatest promise of ameliorating the problem. Because an understanding of the nature of sex behavior, both normal and abnormal, is the first and perhaps most important step in preventing deviations from the normal, this pamphlet should be especially helpful to parents of small children but the material contained in it should be available to everyone. Here at last is a book that gives the average citizen the "facts of life" —not the time-honored facts of the physiology of reproduction but the facts of the development of the emotional reactions to the various levels of the awareness of sex.—*Col. W. G. Brandstadt, MC, U. S. A.*

Medical Benefits and Disability Compensations for National Guard Personnel

Arthur L. Streeter, *Colonel, U. S. A. F. (MC)*(1)

THE following discussion is given in an effort to acquaint the Medical Service personnel of the Armed Forces with the medical benefits and disability compensations to which National Guardsmen are entitled by law. During my 5 years (1946-1951) as Air Surgeon, National Guard Bureau, misunderstanding of the medical benefits authorized for the National Guard arose frequently. This discussion applies equally to the Army and the Air National Guard.

A National Guardsman is entitled to medical benefits and disability compensations while undergoing inactive duty training under Sections 92, 94, 97, and 99 of the National Defense Act of 1916, as amended. The types of training included are (2):

1. Armory drill, or unit training assembly as it is known in the Air National Guard. This is a weekly training period of at least 2 hours' duration. Recently, provisions have been made to allow for a single 8-hour day of training to be credited as 2 training periods.

2. Field training encampment. This is a period of at least 2 weeks of full-time training, and is usually held at a site away from the home station. It normally brings larger units together. Included in this section are various other exercises, such as gunnery meets.

3. Service school training which is attendance at a school conducted by the Armed Forces.

The basic law, on which the current medical benefits for the National Guard rest, is the Act of Congress of 1936 (3). This law provides:

> "That officers, warrant officers, and enlisted men of the National Guard who suffer personal injury or contract

(1) Mitchel Air Force Base, New York.
(2) 32 U. S. C. 32, 63, 64, 144, 146.
(3) Act of June 15, 1936 (49 Stat. 1507; 32 U. S. C. 164a, 164b, 164c).

disease in line of duty while en route to or from or during their attendance at encampments, maneuvers, or other exercises, or at service schools, under the provisions of sections 94, 97, and 99 of the National Defense Act of June 3, 1916, as amended * * * shall, under such regulations as the President may prescribe, be entitled, at Government expense, to such hospitalization, rehospitalization, medical and surgical care, in hospital and at their homes, as is necessary for the appropriate treatment of such injury or disease, until the disability resulting from such injury or disease cannot be materially improved by further hospitalization or treatment, and during the period of such hospitalization or rehospitalization, but not for more than an aggregate of six months after the termination of the prescribed tour of active duty or training in any case to the pay and allowances, whether in money or in kind, that they were entitled to receive at the time such injury was suffered or disease contracted, and to the necessary transportation incident to such hospitalization and rehospitalization and return to their homes when discharged from hospital; and for any period of hospitalization or when they are not entitled to pay and allowances under the preceding provision, they shall be entitled to subsistence at Government expense." This law further provides that, "Officers, warrant officers, and enlisted men of the National Guard who suffer personal injury (as distinguished from disease) in line of duty when participating in aerial flights prescribed under the provisions of section 92 of said National Defense Act as amended shall, under regulations prescribed as aforesaid, be entitled to the same hospitalization, rehospitalization, medical and surgical care, pay and allowances, and transportation, as if such injury had been suffered while in line of duty during their attendance at encampments, maneuvers, or other exercises, or service schools, under the aforementioned sections 94, 97, or 99 of the National Defense Act of June 3, 1916, as amended; * * *."

Although hospitalization is authorized for an indefinite period of time, that is, until maximum improvement has been reached, the pay is limited to an aggregate of 6 months. The guardsman on armory drill, or unit assembly training, is covered by this law only for injury incurred in a military aircraft accident.

The Act of Congress of October 14, 1940 (4), which amends the Act of July 15, 1939 (5), further extends the coverage to allow medical bene-

(4) Section 5, act of October 14, 1940 (54 Stat. 1137; 32 U. S. C. 164d).
(5) Act of July 15, 1939 (53 Stat. 1042, as amended; 32 U. S. C. 164d).

fits for diseases contracted or injuries sustained *not* in line of duty for the period of training only; provided, such disease or injury was not incurred while on armory drill (except on an aerial flight). A disease or injury incurred *not* in line of duty while the guardsman is on a pass of 24 hours or more may not be treated by a civilian physician at government expense nor may the guardsman be hospitalized in a civilian hospital at government expense for such a cause. This law allows the treatment of diseases or injuries which were incurred prior to the beginning of the period of training, but does not authorize such treatment or hospitalization at the expense of the Government after the end of the training period. If a guardsman is in the hospital at the end of his training period for a condition determined to have been incurred *not* in line of duty, it is his responsibility, unless his State pays the bill for him, to reimburse the Federal Government for the hospitalization allowed him after the end of the training period.

The Act of Congress of 1949 (6) extended the medical benefits for National Guard personnel still further. It stated:

"SEC. 3. All officers, warrant officers, and enlisted men of the National Guard of the United States, both ground and air, the federally recognized National Guard of the several States, Territories, and the District of Columbia—

> (1) if engaged for periods in excess of thirty days in any type of training or active duty under sections 5, 81, 92, 94, 97, or 99 of the National Defense Act, as amended, suffer disability or death in line of duty from disease while so engaged; or
>
> (2) if engaged for any period of time in any type of training or active duty under such sections of the National Defense Act, as amended, suffer disability or death in line of duty from injury while so employed,

shall be in all respects entitled to receive the same pensions, compensation, death gratuity, retirement pay, hospital benefits, and pay and allowances as are now or may hereafter be provided by law or regulation for officers and enlisted men of corresponding grades and length of service of the Regular Army."

This law made no mention of burials or of treatment for diseases contracted while on training periods of less than 30 days, but its provisions did not supersede all those of the earlier laws mentioned above. Therefore, burials and treatment for diseases contracted while on training periods of less than 30 days are still authorized by the Act of 1936 and treatment for diseases or injuries incurred *not* in line of duty are allowed by the Act of 1940. This law also removes the 6-month limitation on his pay while a guardsman is hospitalized. When Public Law 108 (6) was passed, there were 108 Air National Guard

(6) Section 3, act of June 20, 1949 (Public Law 108, 81st Congress; 63 Stat. 202; 32 U. S. C. 160a).

personnel—mostly pilots killed in military aircraft accidents—and several Army guardsmen who had died in line of duty since the reorganization of the National Guard in 1946. Fortunately, the provisions of this Act were made retroactive to 14 August 1945 so their beneficiaries as well as those of guardsmen who subsequently died are entitled to the 6 months' pay death gratuity and to pensions the same as the beneficiaries of members of the Regular components of the Armed Forces.

The Career Compensation Act of 1949 (*7*) authorized disability retirement or severance pay benefits for guardsmen who, while on a training status, incur physical disabilities as a result of injuries and are otherwise qualified under that Act. To date only 2 Air National Guard officers and no Army National Guard personnel have been retired under the provisions of this law. Both were injured in military aircraft accidents. While these 2 officers were in the hospital they received full pay and allowances under Public Law 108 (*6*) even though their hospitalization extended beyond the 6-month period formerly allowed under the Act of 1936.

The latest Act of Congress, affecting the National Guard (*8*) provides the $10,000 indemnity for National Guard personnel who die while in a training status in the same manner as for members of the Armed Forces on active service. Although this law is retroactive to 27 June 1950, such National Guard personnel must have been called or ordered to active duty or active training duty for 14 days or more in order to qualify for such indemnity other than such personnel engaged in aerial flights in Government aircraft for any period, with or without pay, as an incident to their military training.

One category of National Guard personnel who are not covered by the foregoing provisions are the caretakers and air technicians while on full-time duty as civilian employees. This duty, however, does not preclude such personnel from the foregoing provisions during the periods while on National Guard training status. When disabled while on duty as civilian employees they are beneficiaries of the Bureau of Employees Compensation, the same as Civil Service employees.

It is hoped that the foregoing discussion will answer many of the questions which may arise in the minds of Armed Forces hospital commanders when asked to admit National Guard personnel for outpatient treatment or hospitalization. In all cases the guardsman should have a written request from his unit commander or surgeon for such treatment or admission. In emergencies this authorization may be submitted after the admission.

(*7*) Section 402, act of October 12, 1949 (Public Law 351, 81st Congress; 63 Stat. 816; 37 U. S. C. 272).

(*8*) Act of April 25, 1951 (Public Law 23, 82nd Congress; AF Bulletin 20, 1951).

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